

# POPULAR MECHANICS

NOV. 1966  
35 CENTS

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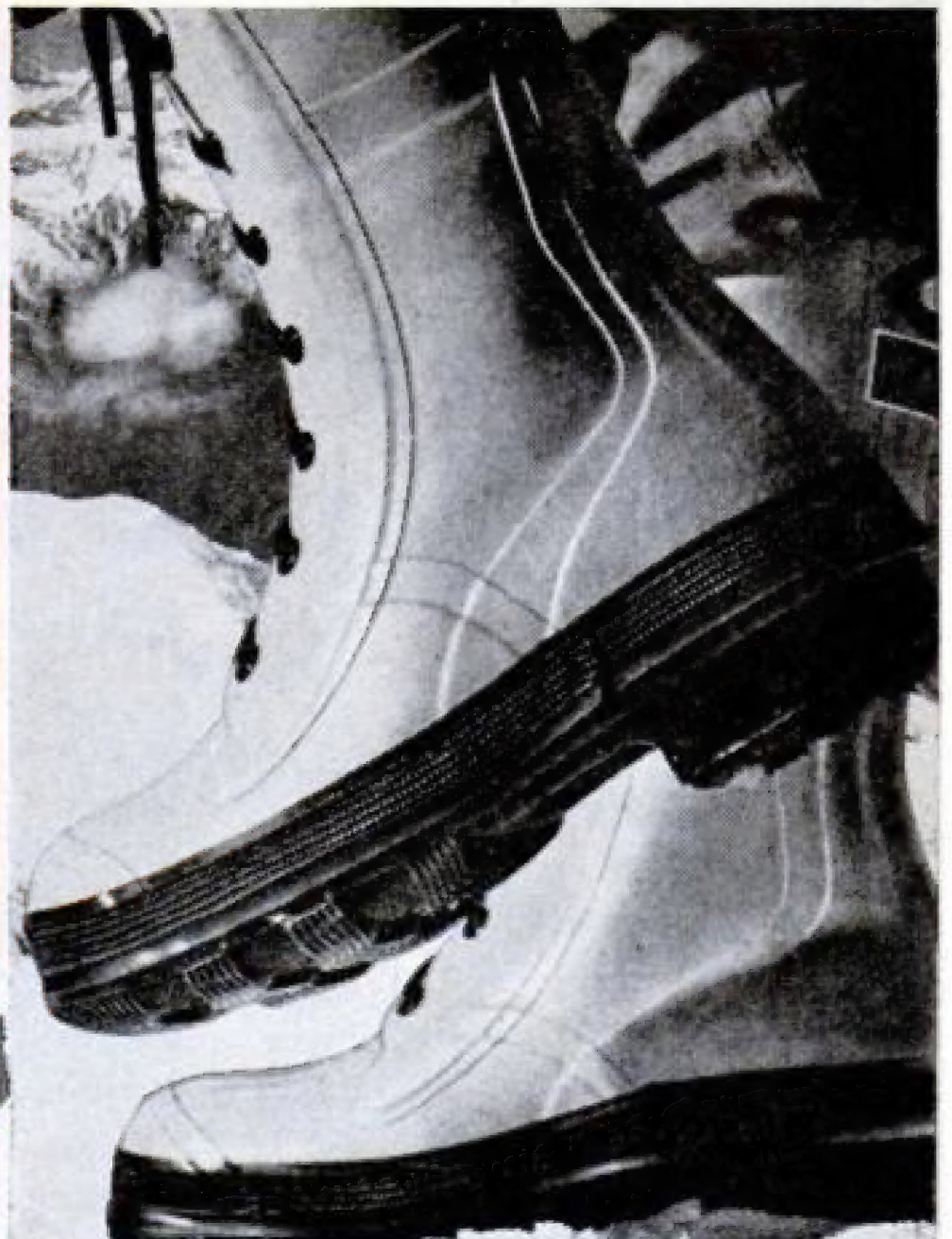
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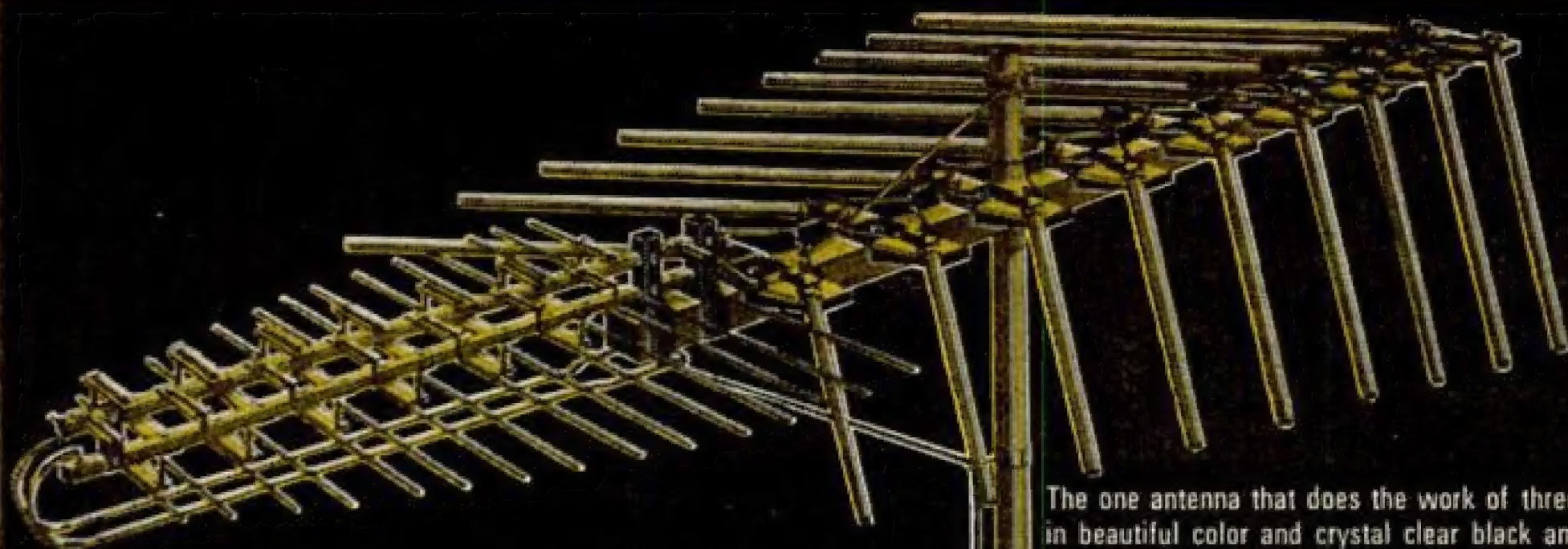
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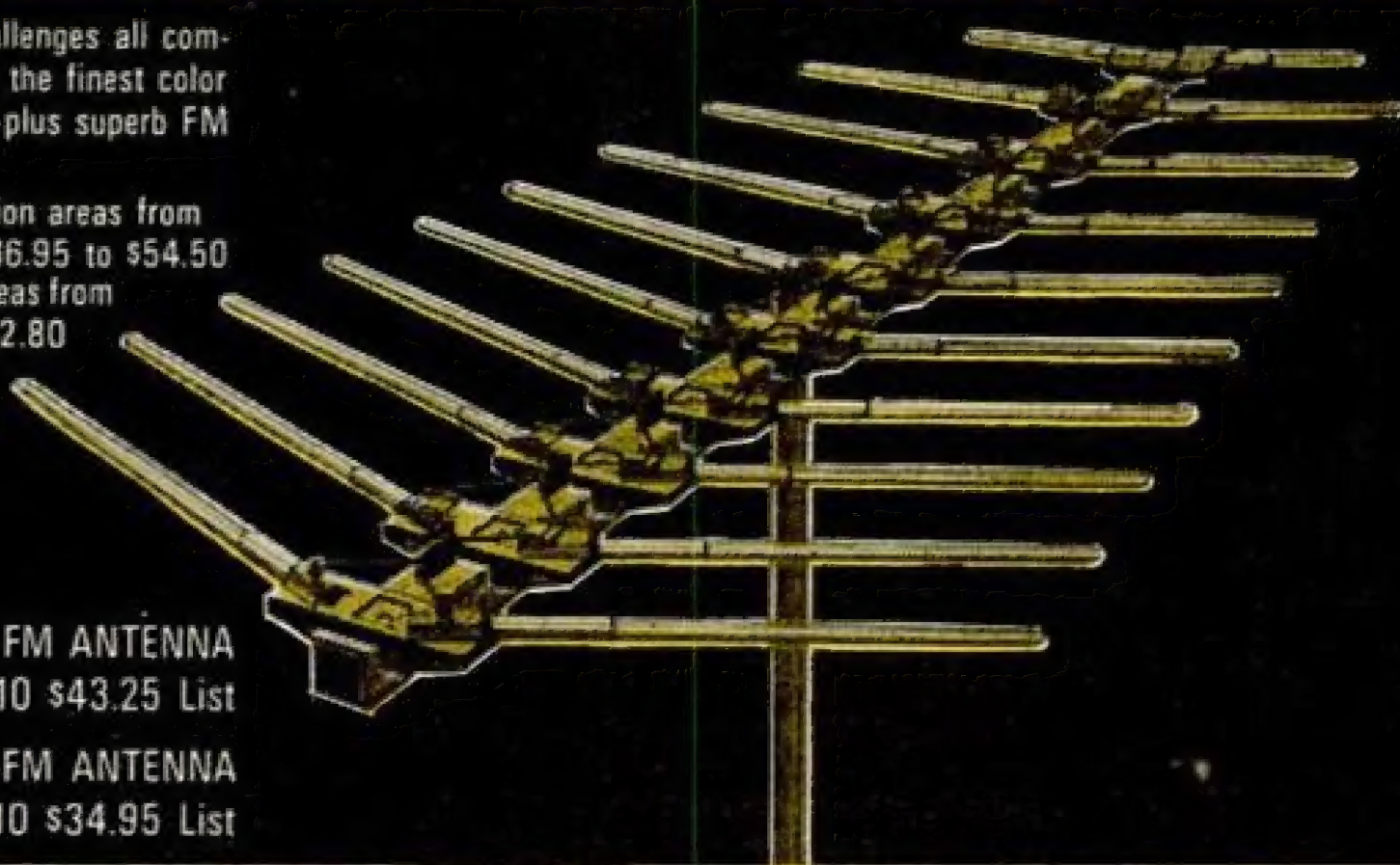
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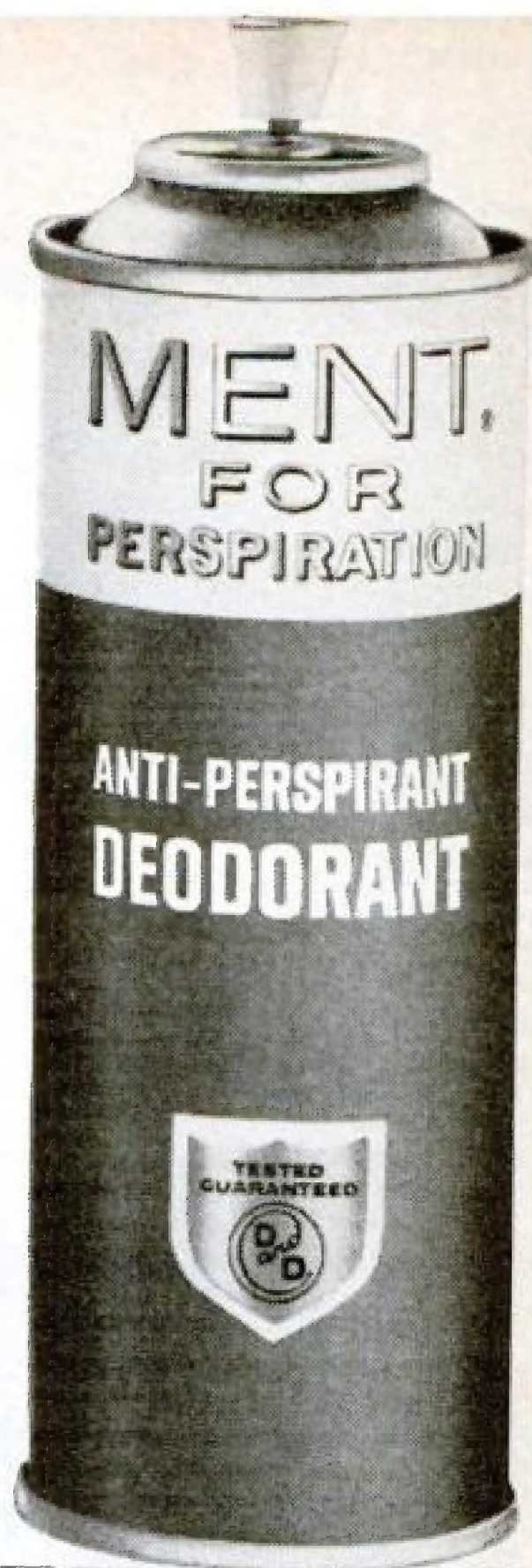
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# LETTERS

TO THE EDITOR

## Life on the turnpikes

Our compliments to you and Ed Fales for the most impressive spread on safe driving featuring the New York Thruway (*How to Stay Alive on the Turnpikes*, page 63, August PM).

Drawing on his experience and discernment, Mr. Fales has come up with some excellent pointers for motorists who use turnpikes. We hope that PM's wide readership will carry the message to millions of drivers and help us in our intensive efforts to reduce the highway traffic toll. New York State Thruway Authority, Director,  
Elmsmere, N.Y. F. WILLIAM DAVIDSON  
Public Information

I wish all drivers would read this article and follow the guidance given. I look forward to other articles on good driving as well as other fine features of PM.

Killeen, Tex. BRIG. GEN. JAMES I. KING,  
U.S. Army, Ret.

I have been driving the superhighways more than 13 years and have approximately 250,000 accident-free miles behind me. I have practiced the methods described by Mr. Fales, and I know that this is the reason I have had no accidents.

I feel that this tremendous article should be read by every driver in the United States.

Lewistown, Pa.

F. H. HELD

## Would you believe '02?

Recently I found a PM magazine dated 1906—along with others dated '08, '09 and '10. I didn't think you had been around that long. Is there anyone who collects your magazine? These issues are all in good shape, considering their age.

Be it '06 or '66, you have a fine magazine which is very helpful and interesting.

Marion, Ind.

DONALD D. BILBEE

Thanks. We've been around since '02 and are all in good shape—considering our age.

## Fan of Dan

I feel that your magazine has achieved a high level of excellence in the August issue. Of course, I'm referring to the story on Dan Gurney (*The Best Driver in the Whole World*, page 86).

It is gratifying to at least one devoted

(Please turn to page 9)



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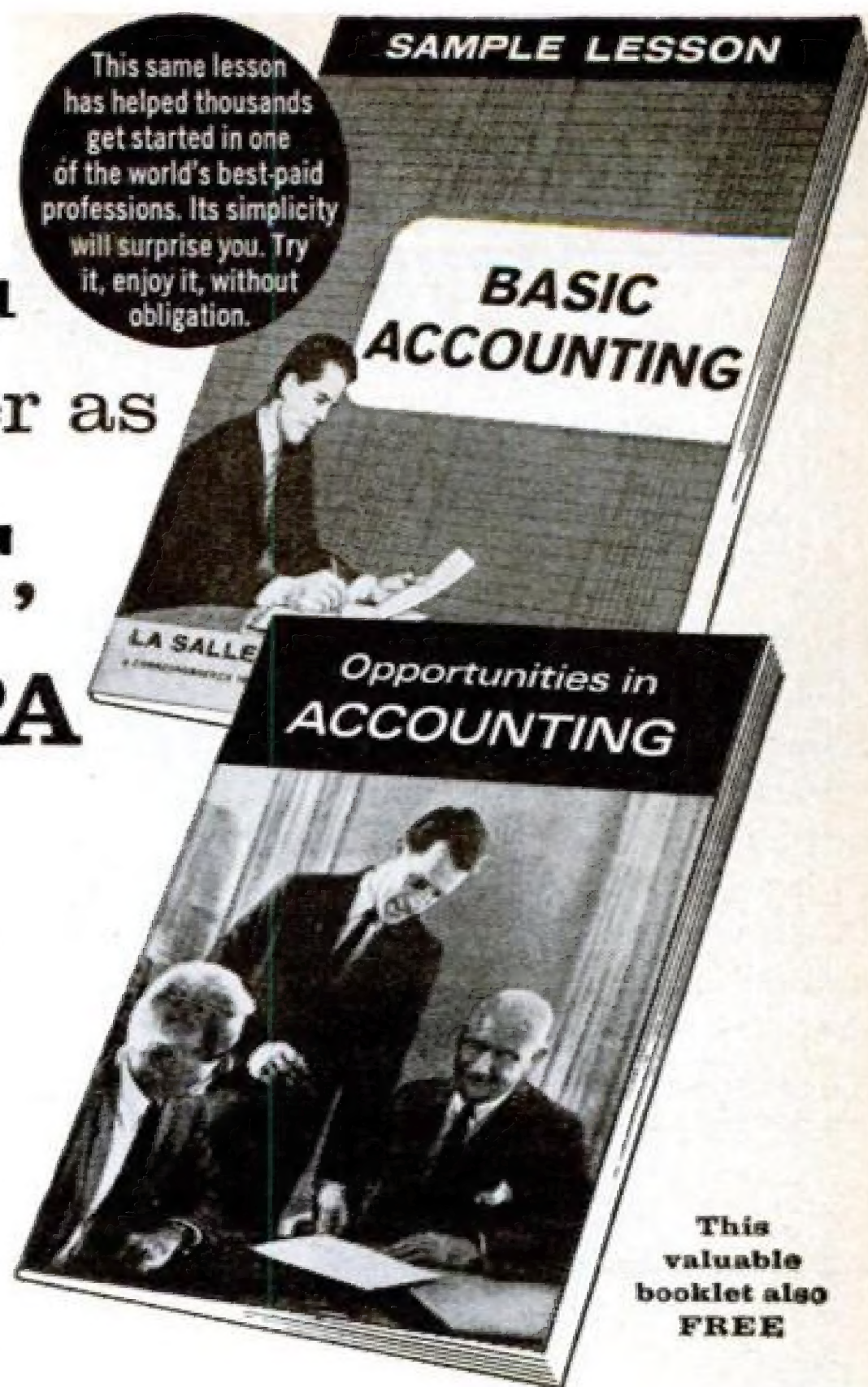
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—Rudolf Urbatis, Port Chester, N. Y.

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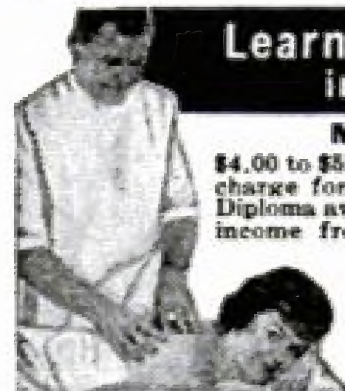
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## LETTERS

(Continued from page 6)

fan of Grand Prix and U.S.R.R.C. races that the outstanding qualities displayed by Mr. Gurney are being recognized by a magazine so widely read as yours.

Wilmington, Del.

CHRIS FRAZER

Dan has some fans here, too (as the title of the article might suggest). And we're flattered to have him aboard as a columnist who'll be answering readers' questions every month in Drivin' with Dan.

### Next question, please

I have read a dozen articles about the loss and recovery of the H-bomb in Spain—including *How We Found the Missing H-Bomb* (page 72, August PM). In none of these did I find one word of explanation as to the parachute. All the writers seemed to consider it perfectly normal for an aerial bomb to wear a parachute, but this is the first time I ever heard of such a thing.

A parachute would destroy the accuracy of any bombsight and might carry the bomb far from its destination or make it an easy ground target.

What can you tell me about this?

Evansville, Ind.

PHILIP A. HAAS

We figured that the folks who tote the bombs around could give us the best answer, so we asked the Air Force "How come the parachutes on H-bombs?" The Air Force's answer, in its entirety: "To retard descent."

Sensing that they were becoming pretty communicative in the wild, blue yonder, we shot back another question—"Do all H-bombs have parachutes?"

The Air Force positively ran off at the mouth this time, and gave us four words: "This information is classified."

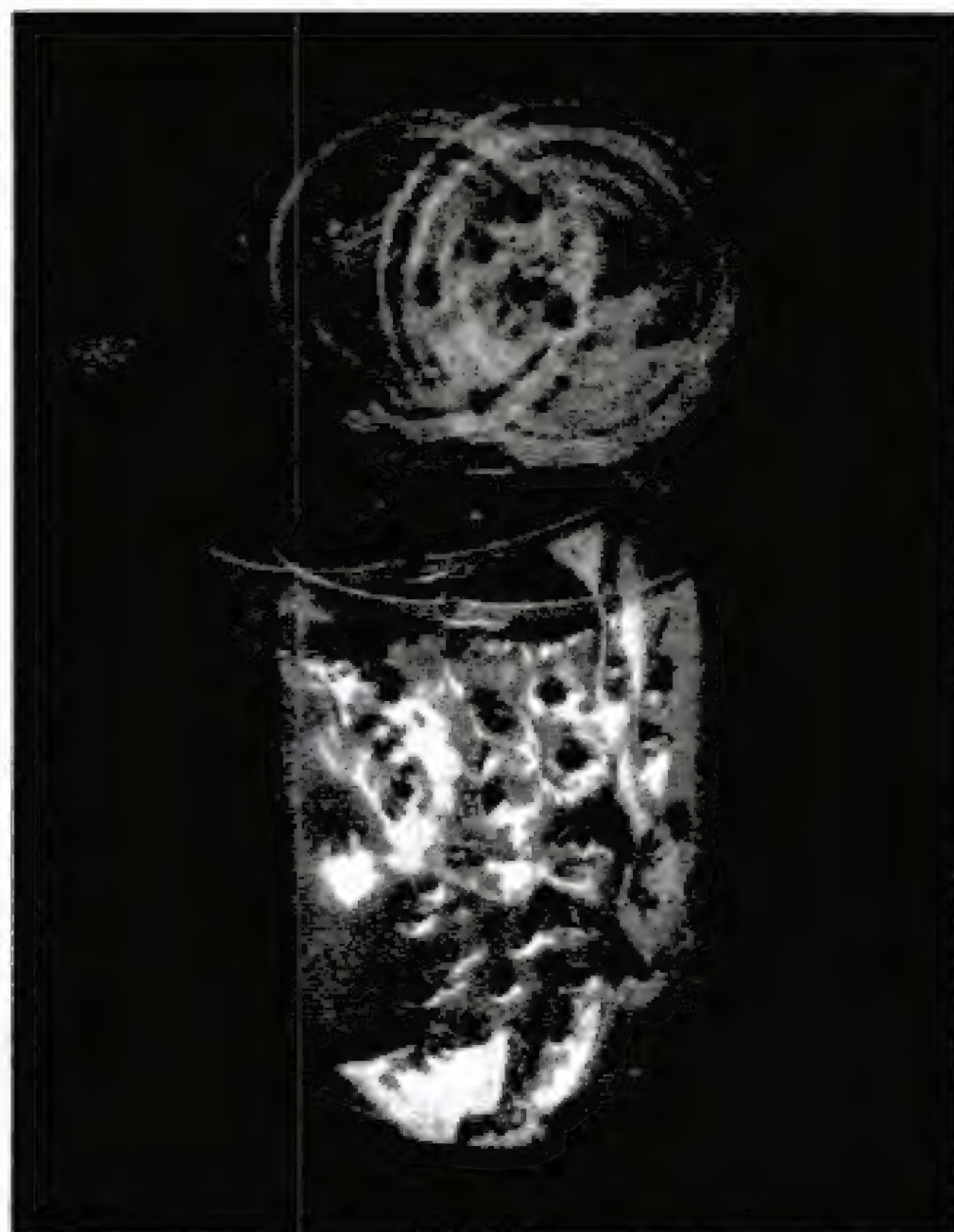
It is true, isn't it—you just can't learn anything unless you ask questions.

### Way-out houseboating

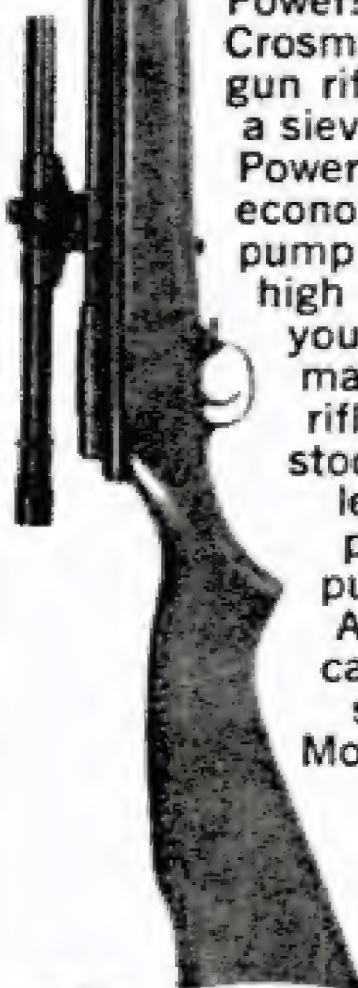
Some of the ideas expressed in the pages of PM have seemed "way out" at the time they appeared. For example, the do-it-yourself houseboat (PM Houseboat, page 160, Dec. 1959 PM) caused a bit of hilarity among the "yachtsmen" in this neighborhood. I had this copy around until recently when a strange new interest caused someone to borrow it.

What is evidently taking place is that boating people have become aware of the basic uses to which they put their craft. These are swimming, fishing, a little cruising in sheltered waters, but very little

(Please turn to page 11)



## CAN OPENER



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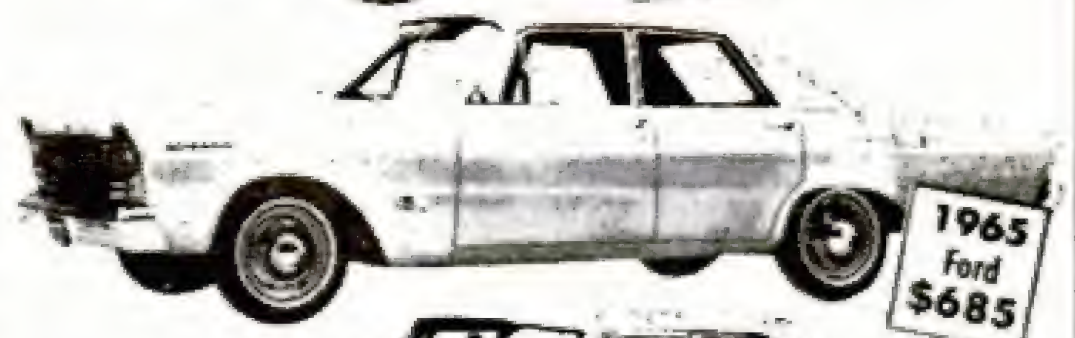
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## LETTERS

(Continued from page 9)

open-water or long-cruise activity. There is no question but that the houseboat allows a degree of comfort not obtainable from any other type of craft. It also lends itself very nicely to family use.

In view of this, would you consider updating the original PM article?

Port Washington, N.Y. PAUL F. JOLY  
(50-year PM reader)

After 50 years, we oughta build one for you. Sure, we'll consider updating—but chances are we'll let that '59 model stand as is and come up with something entirely new and different if we get into that big a boat-building project again. (And by the way, we do like that "way out" label you gave us.)

### Not so hot

The Frantic Fitch Phantom (page 198, Sept. PM) is not as good as Alex Markovich makes it. The handling kit that Fitch adds is not so hot. I saw one of his jobs flip on a dirt road near our summer home. The people in the car got out unhurt, but the car was a total wreck.

Long Island City, N. Y. DANNY MCNERNEY

And sometimes expensive airplanes crash and expensive ships run into each other and all that. Sometimes the driver isn't so hot.

### Honest, fellas

Just finished reading *The Way-Out World of Wacky Insurance Claims* (page 110, August PM) and I can't help but feel that your staff has been taken in by the report of the bricks in the barrel. That little anecdote was popular when I was a youngster in New Haven, Conn., back in the '30s.

Ft. Lauderdale, Fla. JOSEPH CHAMPAGNE

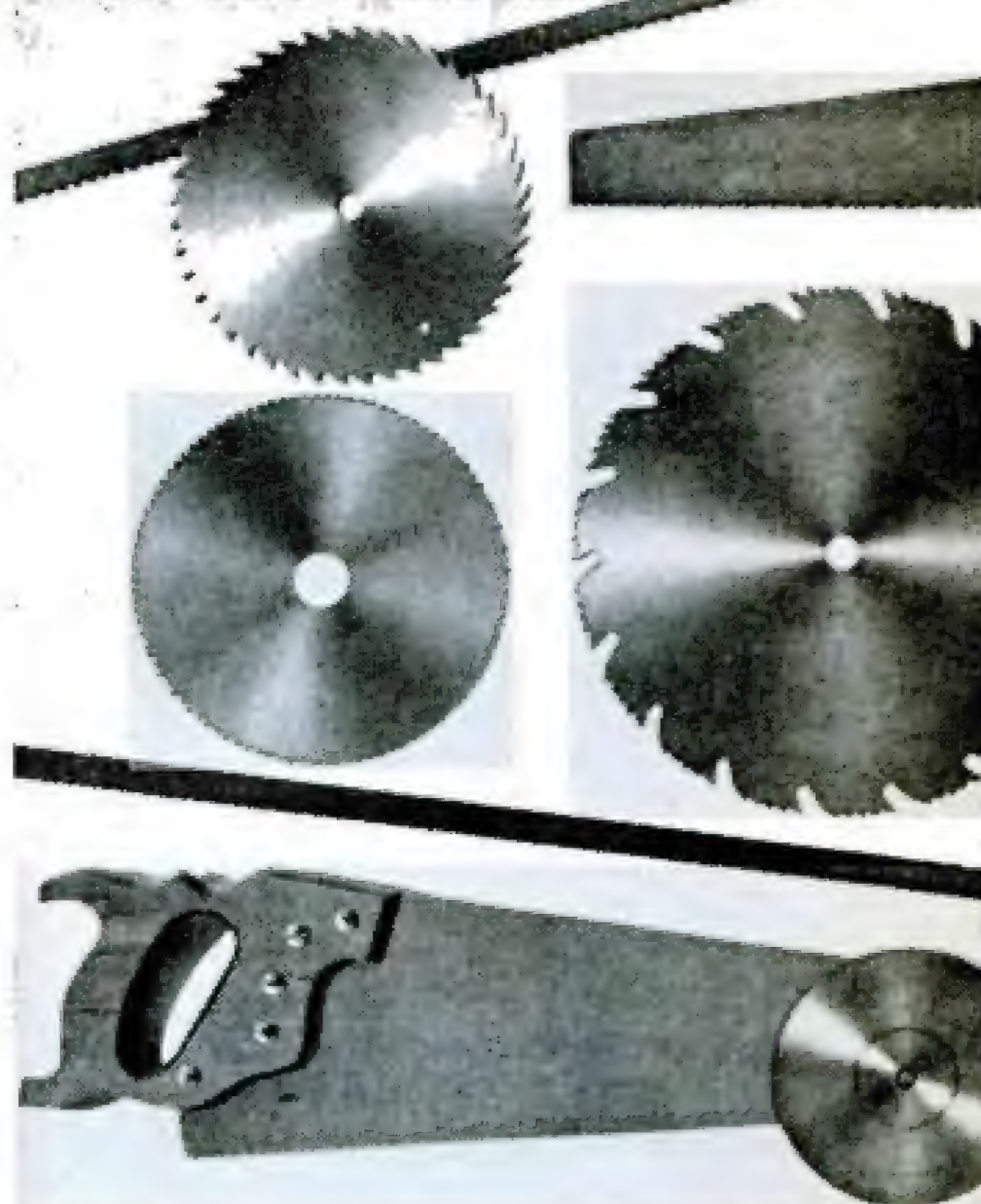
Regarding the overloaded barrel-and-pulley routine where Mr. Hicks claimed "Nobody could make up a story like that"—somebody did, for this same routine was used in silent movies and later in the talkies.

Tallahassee, Fla. JACK MILES

"Honest, fellas, Nationwide Insurance really paid a claim to a guy who had the bumps, bruises, barrel and bricks to prove his case," reports Cliff Hicks from PM's Chicago office. "It happened about 10 years ago.

"Anyhow, haven't you ever felt that life sometimes gets to be like a rerun of an old movie?" he adds philosophically.

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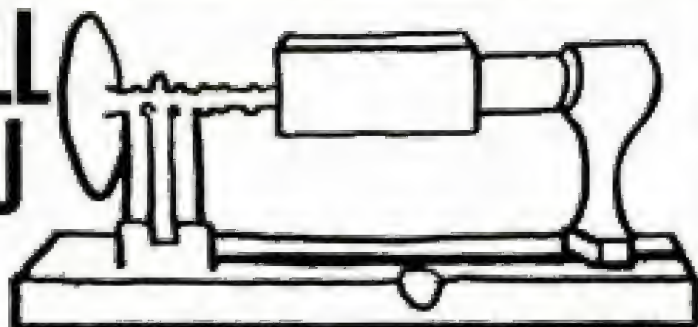
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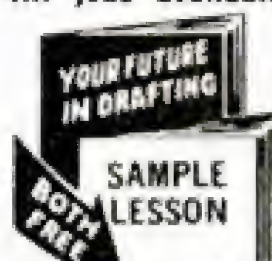
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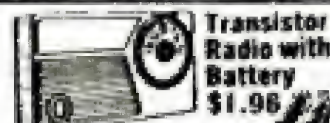
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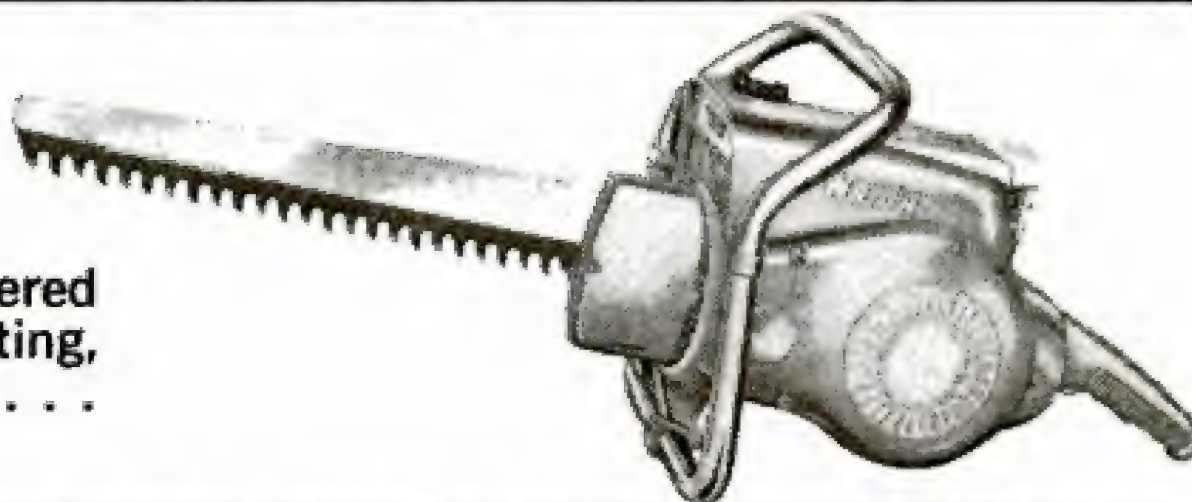


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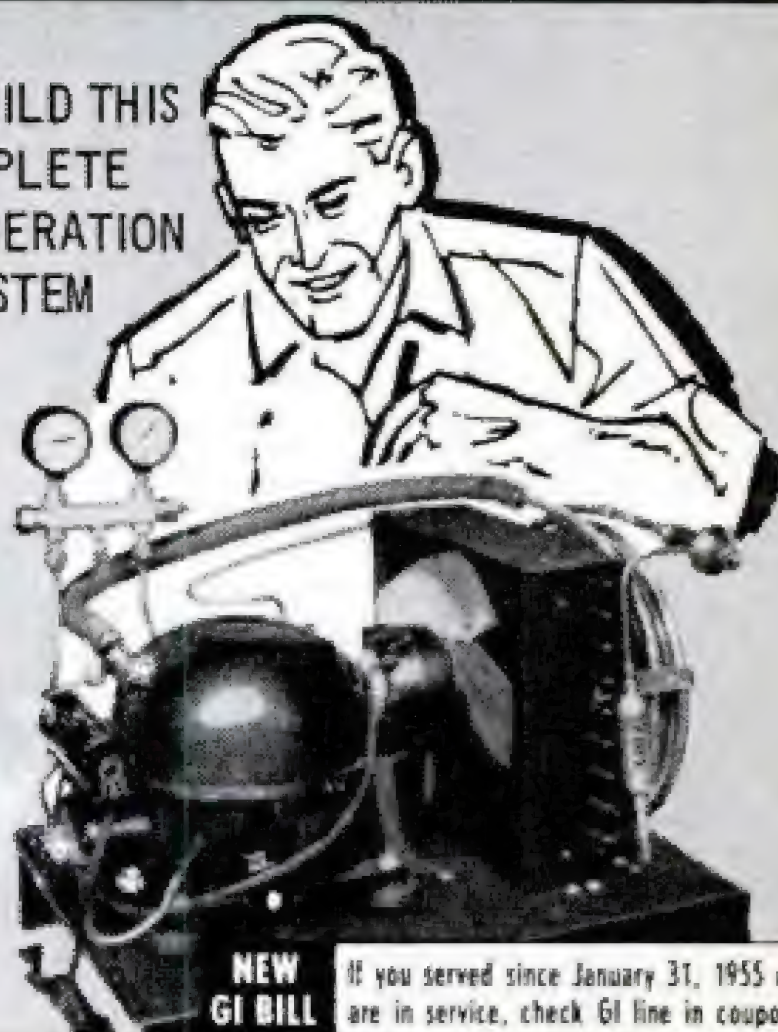


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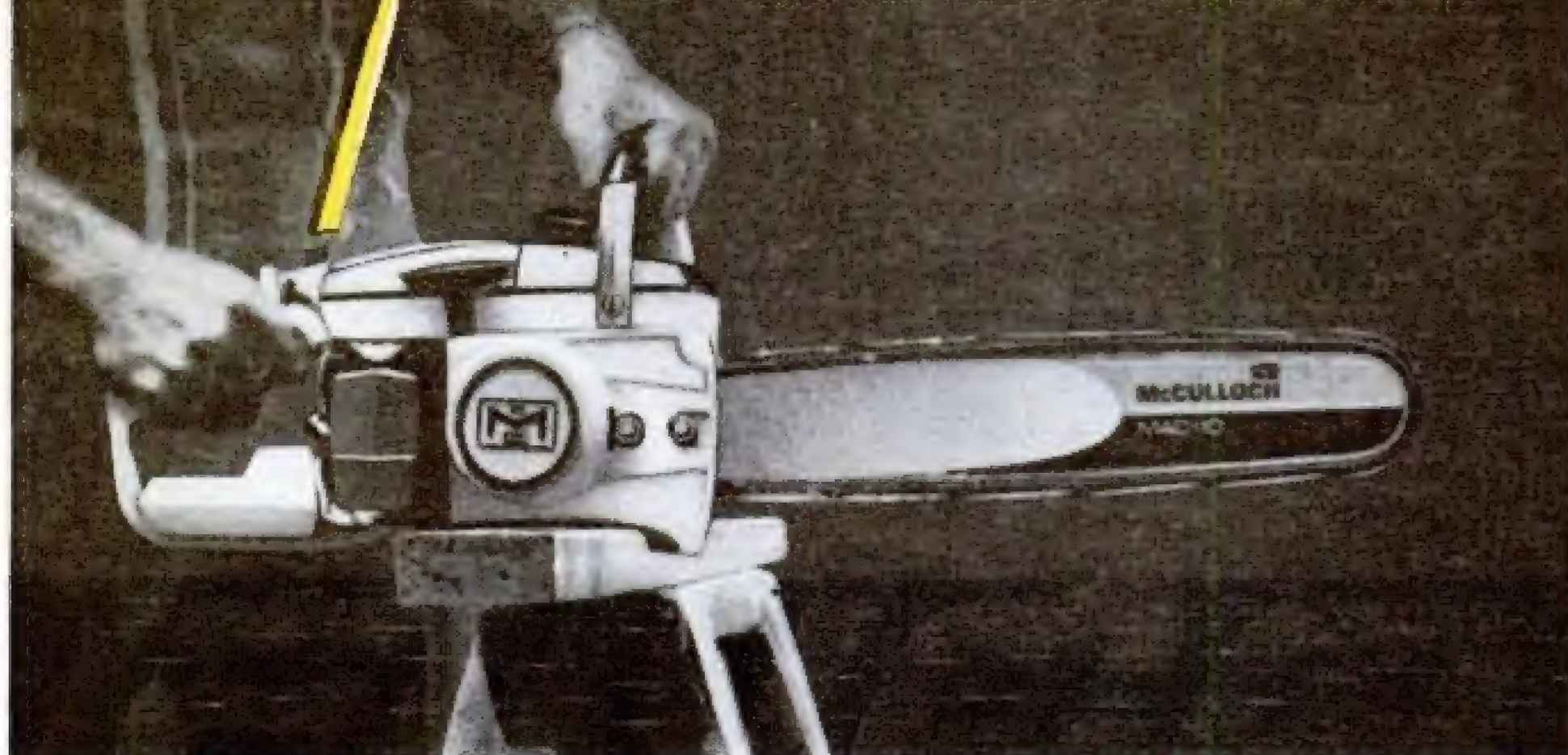
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# PUSHBUTTON STARTING FOR CHAIN SAWS



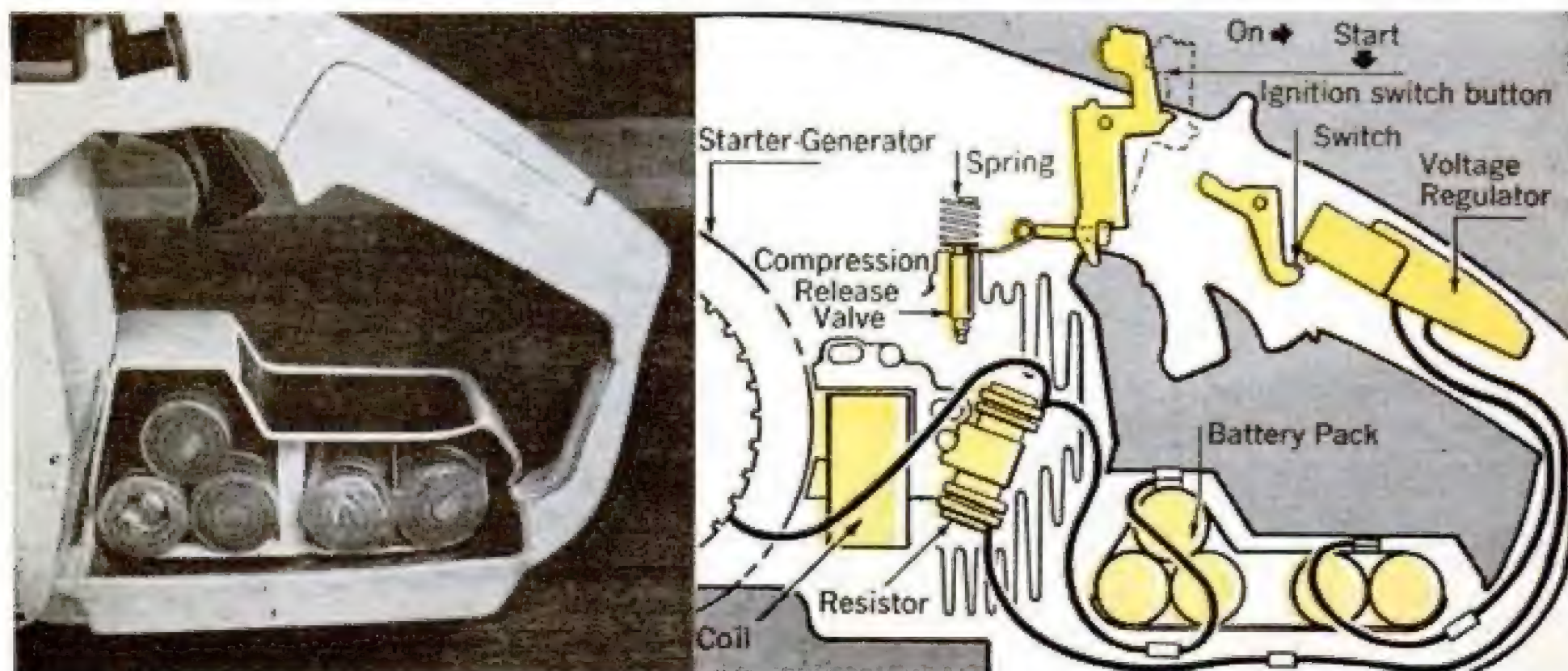
**A**T LAST you can forget that pull-rope when it comes to starting a chain saw. An ingenious system is built into McCulloch's new MAC 3-10E, marking the first time a hand-held gasoline engine can be started electrically by a self-contained starter-generator and battery pack.

Whether you're in the market for a chain saw or not, this breakthrough is bound to influence your future tool purchases. The same type of starter—which adds only 3½ lbs. to the tool's weight—can be incorporated into other small gas-engine equipment, so the day may be

near when the yank-cord will be obsolete on everything from lawnmowers to gas-run drills. The cord's already disappearing from outboard motors. McCulloch is justified in claiming that the new unit is likely to become the most significant advance in engine starting since a car key brought the auto crank to an unmourned end.

Meanwhile, electric starting has special safety advantages for chain-saw users since it's hard to keep the saw from jumping as you yank the cord, and to avoid restarting, many users foolhardily toted the running saw from job to job.

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Get on the big pay wave of today and tomorrow...Electronics! 8 N.T.S. action courses show you how—quickly...Whether it's Color TV Servicing, Radio Servicing, or all around training in the electronics field, N.T.S. is the way to go.

## AUTO-MECHANICS DIVISION:

If you live cars, make cars your living...and build yourself a great future! The N.T.S. way gives you the technical training necessary to become a skilled Mechanic fast in any one of four Automotive fields. Check coupon for courses.

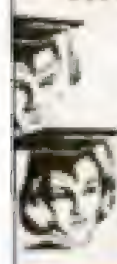
## AIR CONDITIONING REFRIGERATION DIV.:

And the profits! N.T.S. gives you the practical skills that pay off big! Air Conditioning and Refrigeration Technicians are needed right now. Move right into this high-profit field through either of the two courses in this division.

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Servicing and Communications
- ☐ MASTER COURSE IN ELECTRONICS-TV-RADIO  
Color TV and Industrial ELECTRONICS
- ☐ FCC LICENSE COURSE
- ☐ RADIO SERVICING (AM-FM-TRANSISTORS)
- ☐ TELEVISION SERVICING (including Color TV)
- ☐ STEREO, HI-FI and SOUND SYSTEMS
- ☐ BASIC ELECTRONICS
- ☐ ELECTRONICS MATH

### HOME APPLIANCES DIVISION

- ☐ HOME APPLIANCES MASTER TECHNICIAN'S COURSE
- ☐ HOME APPLIANCES SERVICING
- ☐ HANDYMAN APPLIANCE REPAIR

### AUTO-MECHANICS DIVISION

- ☐ AUTOMOTIVE-DIESEL MASTER COURSE
- ☐ AUTOMOTIVE MECHANICS
- ☐ DIESEL MECHANICS
- ☐ ENGINE TUNE-UP AND ELECTRICITY

### AIR CONDITIONING-REFRIGERATION DIVISION

- ☐ AIR CONDITIONING, REFRIGERATION & ELECTRICAL APPLIANCES MASTER COURSE
- ☐ AIR CONDITIONING-REFRIGERATION SERVICING COURSE

### HIGH SCHOOL DEPARTMENT

- ☐ HIGH SCHOOL AT HOME Dept. 201-116

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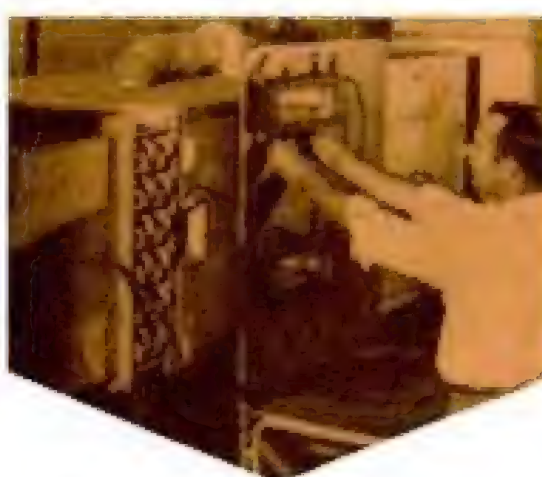
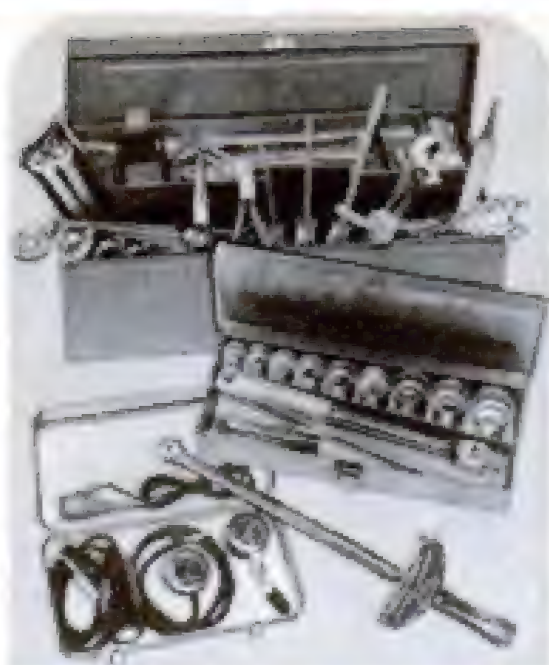
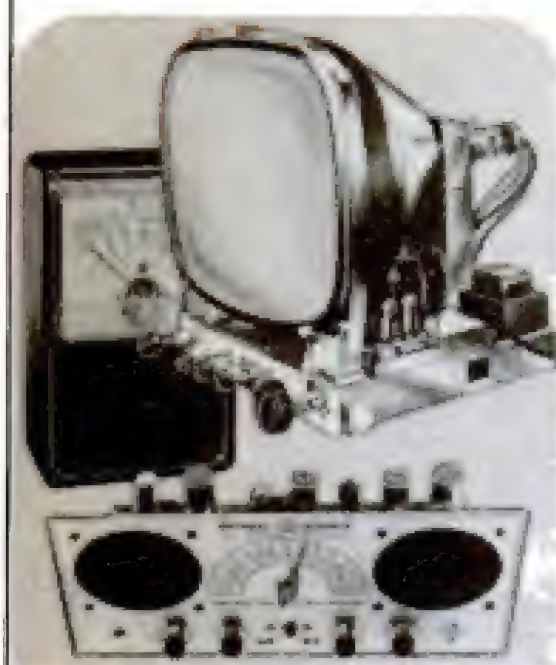


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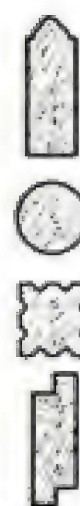
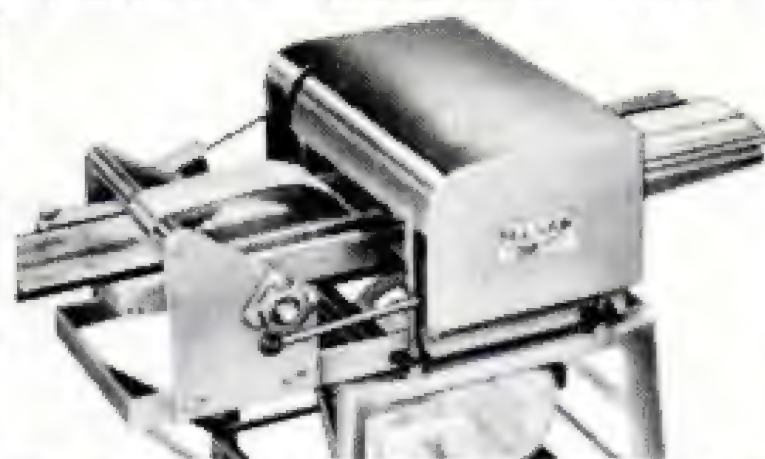
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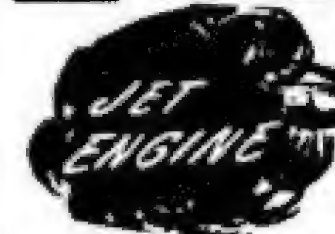
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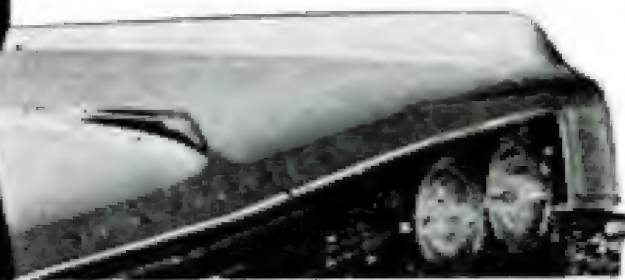
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BY M. J. PEDERSEN

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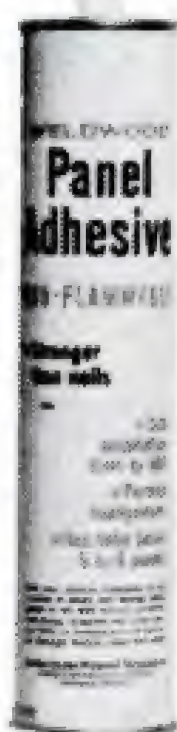


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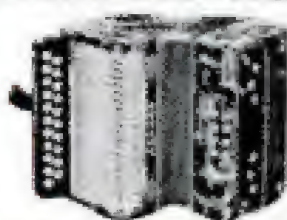
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4421



# WHAT'S NEW **OUTDOORS**

BY STUART JAMES

Roadside rest areas are common on highways across the country, but in most cases they typify a dusty, unkempt cut off the road with a trash barrel and often a picnic table. There are exceptions in the mountains and state and national parks, but for the most part these rest areas are hot, windy, unappealing places for the camping family to stop. During an 8000-mile camping trip last summer I encountered one notable exception—in Ohio.

I have the feeling that Ohio is one of the few states aware that America is on the move in trailers, campers and wagons; it has provided well-planned, beautifully landscaped rest areas where it is a pleasure to stop. Well off the highway, these areas are equipped with clean toilets, running water, telephones, maps and shady picnic areas. This means a great deal to the traveling family and more states should follow the Ohio example.

Shotguns and rifles can be rendered harmless when not in use with a simple locking device that slips into the barrel



and is locked with a turn of a special key. Called Gun-Lok, it sells for \$1 from William B. Hartman Co., 4780 Old Orchard Trail, Orchard Lake, Mich.

When are legislators going to make one fishing license—like a driver's license—acceptable all over the country? Last summer I paid \$3.50 to fish Trout Lake near Silverton, Colo., for three hours, and two weeks later paid another \$3.50 to fish the Gunnison River. When I saw the Snake River in Jackson, Wyo. I had to stop and fish—another \$4. And besides this, I bought licenses in California, Indiana, Nevada, Minnesota, Wisconsin, Pennsylvania, New Jersey, Connecticut and New York. For any outdoorsman on a long trip who wants to fish—if only a few hours—the fabled waters of this country, this multiple licensing is a ridiculous financial hardship. ★★★

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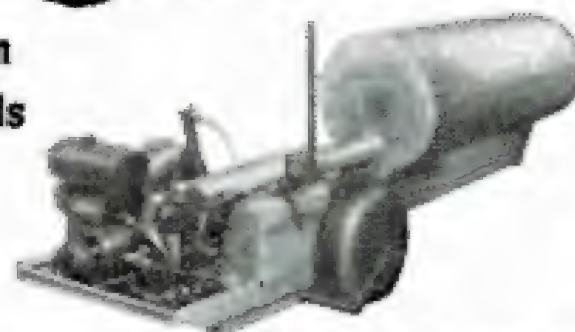
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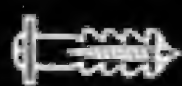
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BY JOHN F. PEARSON  
**SCIENCE**  
WORLDWIDE

**Flying saucer enthusiasts** tend to be elderly, in poor mental and physical health, and have low levels of formal education. So says a researcher at the University of California's School of Criminology, Berkeley, who "joined" a number of flying saucer clubs while studying them over a three-year period. He also notes that most members are widowers or single and come from a lower middle-class background.

**Frozen milk** in cartons one-third the size of present ones may be on the market in about a year. That prediction comes from a University of Wisconsin scientist who explains that the development of frozen concentrated milk had been delayed by a sticky problem—the crystallization caused by lactose, a milk sugar, making the milk taste chalky and look curdled. But it was found that crystallization can be avoided by adding lactase, an enzyme that decomposes lactose into dextrose and galactose.

**Therapy from the sea.** Scientists at Montreal's McGill University report that sodium alginate, a substance found in brown kelp seaweed, shows promise as a preventive of bone cancer. In tests with rats, the alginate combined with strontium-90 in the intestines of the animals, permitting them to excrete it. Thus the cancer-producing strontium had no chance to get into the animals' bones.

**Hand-held radar** that weighs only 2 pounds and that can operate for 10 hours from a small battery pack has been developed by a major electronics firm for use by our armed forces. The device can detect a moving man at 1000 feet, says the maker, and can indicate whether the target involves one or more men and whether a vehicle is a truck or a jeep.

**Any ideas?** A spokesman for the Pharmaceutical Manufacturers Assn. reports that both industry and government are eager to find a design for a medicine bottle that children can't open. So far, attempts to devise a "really effective closure" have failed.

**Billions of watts of electricity** may be supplied to cities of the future in the form of high-frequency radio waves transmitted through underground pipe-

lines of foam plastic. Stanford University engineers say the method would have these advantages over conventional power lines: It could carry bigger loads, would be shielded from attack by the weather or an enemy nation and would eliminate unsightly towers.

**Pigeon-toed or bowlegged football** players are the least likely to run into knee trouble, say doctors in an American Medical Assn. report. The reason: alignment of their leg bones minimizes stress on the knee joint.

Players with normal legs are advised to build up strength in their thigh, hamstring and calf muscles, and to shorten and quicken their stride when in danger of being tackled or blocked. This lessens the time a foot is on the ground, the only time a knee injury can occur.

**Soviet "stereoscope."** A double-channel telescope using two 20-inch mirrors has been built by Russian astronomers for making more accurate measurements of the brilliancy of stars. The star being measured is observed through one channel and another star of known brilliancy is viewed through the other. This gives an increase in accuracy of photoelectric measurement and reduces the effect of atmospheric disturbance.

**When do you brush?** Recent survey of 1000 families shows, according to a report in the *Journal of the American Dental Association*, that wives and children are more conscientious about brushing their teeth than husbands. Seventy-one percent of the wives brush their teeth at bedtime; so do 69 percent of the children and 60 percent of the husbands. After-breakfast brushing is done by 56 percent of the wives, 58 percent of the children—but only 39 percent of the husbands.

**Triumph of detection.** A Swedish technician claims to have rediscovered the formula for making the lacquer used on the famous Stradivarius violins. Using spectroscopic and other methods of analysis on a tiny chip of centuries-old lacquer, he determined the ingredients, mixed up a batch and applied it to violins he'd made. Experts say they can't tell the difference between the sound of a "Strad" and the new Swedish instruments.



# SOLUTIONS FOR MECHANICAL HEADACHES

# AUTOMOBILE CLINIC

BY MORT SCHULTZ

## Stick vibrates like crazy

Several of us '65 Mustang owners have the same complaint. The shift levers of our four-speed sticks vibrate like crazy from 2500 rpm and up. Body and engine mounts and wheel alignment have been checked. A tighter spring has also been inserted. I don't mind driving with one hand holding the lever, but over 65 mph, I'd prefer having both hands on the wheel.

—Donald R. Thomas, Bronx, N.Y.

This was a problem with the three-speed stick, Don, but I haven't heard of it before with the four-speed. In fact, Ford issued a new grommet kit for the three-speed that seems to have solved it. For yours, the only thing I can suggest is that you take the shift tower apart and check the grommets. If worn, put new ones in. In any case, pack the shift tower with white grease—it might stop the vibration.

## A big one missed

In the April Auto Clinic, a reader asked where he could get parts for a 1928 Ford. You mentioned several companies, but not ours. I'm aggrieved, since J. C. Whitney & Co. has the largest selection of automotive parts anywhere. They include listings for 1928-31 Model A Fords, as well as a lesser line-up for the 1909-27 Model T Fords. We would appreciate it if you'd keep us in mind.—Harry J. Stein, J. C. Whitney & Co., Chicago.

How or why I ever left Whitney out of the line-up is beyond me. Must have had my head in the coffee cup the day I wrote the thing.

## Has that plugged-up feeling

The cooling system of my aluminum-engine Buick is well plugged with flakings. At the suggestion of my Buick dealer, I had the system cleaned and have been using year-round GM coolant. It hasn't helped. I'm ready to dump the car unless a solution is forthcoming from you.—Jack Simpson, San Francisco.

This has been a rough problem for cars with aluminum engines, but it usually happens when a substitute is made for the recommended coolant. Once these deposits form, it's difficult to reverse the action. Buick, however, has issued special service letters to dealers—Nos. 391 and 414—that may turn the trick. Afterward, make sure you use the recommended coolant at all times.

## Dealer had better shift gears

My 1965 Valiant with standard shift grinds when you put it into first gear. From time to time, it will grind when shifting up into second or third and when downshifting as well. I've gotten the brush from my dealer, who says it's normal. I'm willing to buy that if you say so. Oh yes, I've been driving manual-shift cars for years and I know how to clutch—Alan Schwartz, Yonkers, N.Y.

Uh, uh. I just don't buy this "normal" angle. Plymouth is too good an outfit to build "normalcy" into cars by making gears clash. As long as you're shifting properly, I'd start suspecting a bad synchromesh. Maybe it's sticking or it has too much end play. Other causes: dry pilot bushing, misaligned clutch housing and out-of-adjustment pressure-plate fingers. Nonetheless, I'd start beefing like mad.

## A starved Chief dies

When I'm running along and take my foot off the gas of my '64 Pontiac Star Chief to brake, the engine often dies. It seems to happen more often when going up a hill and is more likely to occur with the airconditioner operating. The car's equipped with power steering and power brakes. The Pontiac dealer can't find anything.—Dr. H. L. A., Tuscaloosa, Ala.

Since the car acts up when the load is removed, the problem is most likely a sticky throttle return check. Also, look for a partially plugged fuel filter and a maladjustment of the carburetor float level.

(Please turn to page 24)



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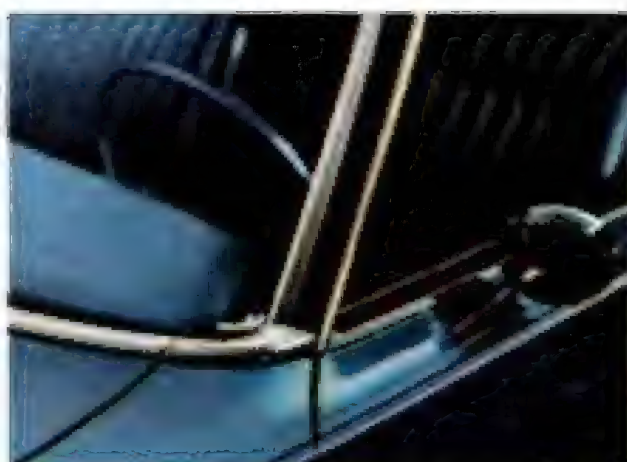
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*Leave it to Pontiac to come up with it first: now you can order a hood-mounted tach!*





## AUTOMOBILE CLINIC

(Continued from page 20)

### Gasping for air

*I've got a '65 Comet sports coupe. The only problem with it is that when you come to a stop, the engine chucks, lops and dies. Is this a persistent problem with this car? I have three friends with the same autos who are awaiting your answer as well. The dealer, of course, finds nothing.*—Archie Bogues, Whittier, Calif.

Your answer may be buried inside of SB 30 (2/19/65). It seems that an intake air leak between the carburetor and spacer and the spacer and manifold gaskets prompted Mercury to issue improved gaskets. It might be that you need these installed (Part Nos. C5AZ-9447-A, C4AZ-9447-B), so have your dealer check for a

leak there. The trouble also applied to '65 Mercurys with the 390-4V engine.

### We talked too high torque

*In reading the July Auto Clinic, I note that you said the maximum torque for sparkplugs in aluminum cylinder heads is 40 ft.-lb. Sorry, Mort, you're wrong. This is considerably above the torque recommendation, and we believe it could be dangerous.*—Elwyn Herrick, Service Dept., AC Spark Plug Div., General Motors, Flint, Mich.

Right you are. Thanks for calling it to our attention. The correct torque is, in fact, only 15 to 22 ft.-lb., depending on the plug's reach. A good rule to follow, of course, is to double check any specification you find in print against the manufacturer's spec.

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## Service Tips

- **A rough idle** when the vacuum windshield wipers are operating in 1965 and 1966 Ramblers that are equipped with 287 and 327 engines has been traced and corrected by the company. Have your dealer look to TSB 9 group 1.000 (6/13/66). It calls for cutting the positive-crankcase-ventilation hose midway between the PCV valve and carburetor, installing a "T" connector (Part No. 3188526) for the wipers and then replacing an elbow fitting in the intake manifold with a plug (Part No. G-103865).

- **Concentrate on the white spot.** If you have a 1966 Cadillac with a V.I. number from 223002 to 237928, check the radiator cap rivet. If it has a dab of white paint on it, no sweat—the coolant was checked before the car was delivered. If not, get it back to the dealer. Some of these may have been shipped with an incorrect concentration of ethylene glycol in the coolant solution. Cadillac reminds you that the proper glycol concentration is important for its corrosion-protection qualities.

- **Take a cool dip.** Pontiac's stuck a small reminder in its service news that we can all benefit by: "When checking engine oil level, the reading on the dipstick will vary depending on oil temperature and drainback period. With a cool engine, the oil has had a chance to drain down into the pan, resulting in a proper dipstick reading, in some cases, slightly above the 'full' mark." Get the message?

- **For sagging clutches.** Does the clutch pedal in your '66 Dodge Coronet six-cylinder fail to return beyond the point of free play every time? No problem, now. The condition can be corrected by the installation of a clutch-fork return spring (Part No. 2643705). Your dealer has the word on it via TSB D66-32 (5/25/66).

---

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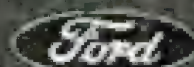


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Domestic Refrigeration Heating  
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Industrial Heating  
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Salesmanship

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Commercial  
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Professional Secretary  
Shorthand  
Stenographic  
Typewriting

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Foundry Practice  
Industrial Metallurgy  
Lathe Operator  
Machine Shop Inspection  
Machine Shop Practice  
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Metallurgical Engineering Technology  
Milling Machine Operator  
Multicraft Maintenance Mechanic  
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DETROIT

# LISTENING POST

BY BOB IRVIN

**Your new 1967 car will be more corrosion-resistant than ever.** Although extent of usage varies from make to make, all the '67s have zinc-galvanized steel in portions of their underbodies—rocker panels, fender shields, quarter sections, radiator bands, rear floor panels, lower door strips, front torque boxes, and so on. Some makes are using sheet metal galvanized on one side in doors and fenders. Even American Motors, which for over eight years has dipped entire car bodies in a special zinc-based primer, is using more galvanized steel in its '67s.

The industry's antitrust efforts stem from increasing use of salt to melt highway ice and snow. Salt is hygroscopic—it attracts and holds moisture; in highway use it tends to accumulate along seams and in crevices of a car's underside, developing a brine that promotes and accelerates corrosion. The zinc coating fights this action by protecting the base steel from moisture, even when it's cracked or scratched.

Attacking the problem from the opposite end, a company called Cargill Inc. claims to have developed a salt that greatly reduces galvanic corrosion. Test cars driven on Minneapolis streets treated with the new product—called Carguard—were said to have been much less corroded than similar cars operated on Milwaukee streets treated with plain rock salt. A chemical in the new product attaches itself to the positively-charged car metal and forms a protective coat, according to the manufacturer.

What's wrong with regular undercoating? Nothing, except that for maximum effectiveness it must be applied to absolutely clean metal throughout, virtually impossible once the car has been assembled; otherwise, moisture can get under the asphalt. More obvious, of course, is the fact that undercoating can't be sprayed on hidden parts.

**Radial-ply tires as standard equipment?** Probably, and within five years, says Ford Div. boss Don Frey. FoMoCo this year is pioneering the use of radials on U.S. production cars, making them standard on Mercury's Colony Park wagon and regular production options on big Fords and certain Falcons. Frey ventured that by 1968 over 100,000 American cars—virtually all Ford products—would be equipped with radials. Ford apparently has pretty much cornered the market for radials, Frey saying the company has contracted with Goodyear, Firestone, U. S. Rubber, Goodrich and General to take all such tires they can build.

Ford decided to use the tires only after modifying the suspension systems of its cars to eliminate the supposedly harsh ride of radials. Frey says "tuning" a car to the tires involves "sorting out frequencies of vibration and making necessary changes in springs and body mountings." Ford tests have shown a 30 to 80 percent improvement in tread wear with radials, one reason being there's less cord friction because each ply is set at a 90° angle to the bead. Conventional bias-ply tires have the cord set at a 20° to 30° angle to the side of the tire.

**General Motors' 1968 intermediates will have three different wheelbases,** not two as originally thought. The Chevelle, F-85, Tempest and Buick Special will appear as 112-inch two-door sedans and hardtops, 116-inch four-door sedans, and 121-inch station wagons. Cars now have 115-inch wheelbase. So, after growing inch-by-inch for the past several years, the intermediates appear to be retracing steps toward their compact origins.

**There's a double shoulder harness in your future.** And what's more, in all but the most severe impact accident, it will probably save your life. Studies by the Los Angeles Police Dept. indicate a double shoulder harness—anchored at about shoulder height and used in combination with a lap seat belt—offers the best protection yet for most

*(Please turn to page 32)*





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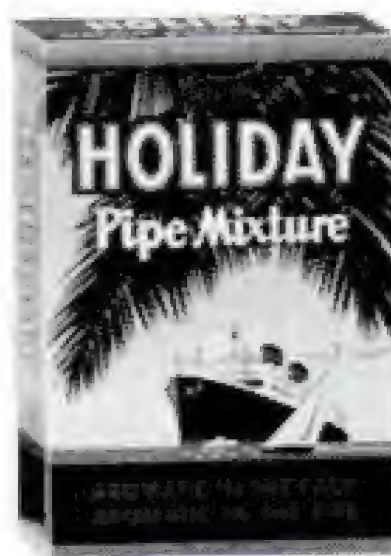
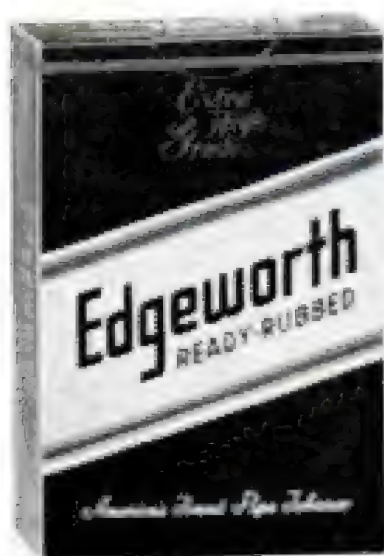
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OFFER ENDS JAN. 31, 1967. Limited to U.S.A.  
One pipe per customer. Void where prohibited.

## DETROIT LISTENING POST

(Continued from page 30)

drivers and passengers involved in accidents. The studies turn thumbs down on the single strap harness (like those offered as options on the '67s), saying such rigs can cause serious neck damage in high-speed collisions. L.A.P.D. reports that while restraining devices are not a total solution to the problem of reducing auto fatalities, they can spare motorists from serious injury and death in many situations. Double shoulder harnesses have been proved particularly valuable in right-angle collisions and also guard against the impact consequences of faulty door locks, shattering glass and looming dashboards.

At least two Detroit auto manufacturers are studying the double-harness idea. They're "checking into" an American Seating Co. design consisting of a lap and shoulder(s) arrangement hooked up to an inertial locking reel; a device similar to those used successfully for years by many professional stock car drivers. Dacron straps fit over the shoulders and lap and are attached to a take-up reel mounted above and behind a seat occupant's head. A self-winding drum that takes up strap slack makes possible normal driver or passenger motions. But in any sudden impact wherein force greater than one-and-a-half times gravity is exerted upon the reel, it locks instantly, thus keeping the seat occupant from pitching forward. The harness is reported as comfortable to wear and able to handle loads up to 5000 lbs.

"Immediate delivery" of any new car you order may soon *really* be true in your area. For years dealers have had an informal arrangement whereby they swapped cars to supply buyers with specified models. But now things are being formalized. In the Los Angeles area, for example, 74 Dodge dealers use a computerized central "trade bureau" that enables them to quickly comb their common 6500-car inventory to find whatever car a customer may want. The operation so far has been a success; it may be duplicated throughout the country.

Use your windshield washer with care this winter; careless use can blind you in seconds. How come? Spraying your windshield when your car is at speed tends to evaporate the antifreeze in the washer fluid. If the temperature is below freezing, the result can be a quick and blinding coat of ice. When it's below freezing, the National Safety Council suggests pulling

(Continued on page 33)



(Continued from page 32)

over to the curb or road shoulder before using your washers.

Specialty vehicle makers are scrambling to comply with the new federal auto safety law. In many cases their problems are complex, with solutions requiring drastic revision of present designs. Travco, manufacturer of the Dodge motor home, for example, is having trouble with—of all things—the dinette seat. At present built like any other dinette seat, it has to be redesigned to qualify as a passenger-car seat, the vehicle being registered as a car in 44 states. To meet the new law the seat will have to withstand certain "G" loads and be adaptable to lap and shoulder safety belts. Redesigning the seat involves problems of stowage and convertibility, as well as higher production costs.



Giant concrete "tennis rackets" that have appeared recently in Tokyo are not for playing games. They are the supporting structures for a new highway interchange in the city. The new roads will be supported on the top and middle cross members of the concrete rackets. A third road will be built on the ground. Each concrete racket is 25 feet wide, and each road level will be 25 feet above the one below. Main advantage of the racket construction is space saving, say the engineers.

# Test your automotive I.Q.



*What does this "dial a go-go" tell you?*



*What does this symbol stand for?*

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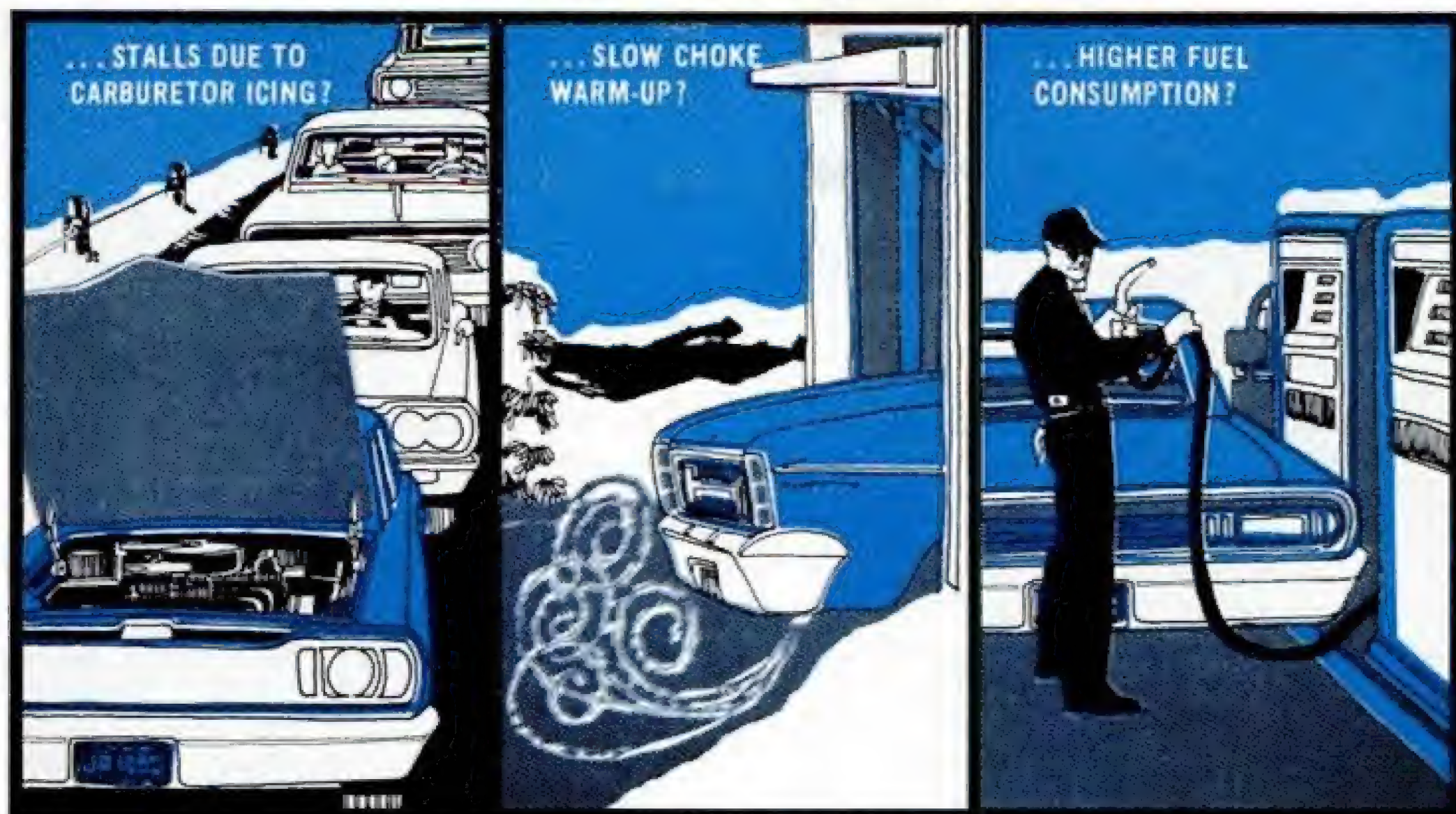
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**OLDS MEETS THEM HEAD ON  
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## CLIMATIC COMBUSTION CONTROL

Winter used to be hard on a car (and on a car operating budget). Now Olds has turned the tables. New *Climatic Combustion Control* automatically mixes manifold heated air with underhood air at the carburetor to virtually eliminate carburetor icing, reduce choke warm-up time and cut fuel consumption in the bargain. It's available on any Rocket V-8 Engine. Another reason why the Rocket Action Cars are out front again!



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LAWS  
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Olds thinks of your safety, too, with the GM-developed energy-absorbing steering column that can compress on severe impact up to 8 1/2 inches; with four-way hazard warning flasher; outside rearview mirror; dual master cylinder brake system, plus many other safety features—all standard for '67.

Engineered for excitement . . . Toronado-style!  
**'67 OLDSMOBILE**





In the driver's seat of . . .

# The Lively Lotus-Cortina

By MIKE PRIESTLEY

**Y**OUR LOCAL FORD DEALER may have a surprise for you—probably one of many, to be sure, but if he happens to have a franchise and has a unit available, a demonstration drive in British Ford's Lotus-Cortina could well change your thoughts about "those funny-looking little foreign cars." For here, mister, is a real marcher.

Based on the well-established Ford Cortina, the Lotus version is a very different breed of cat. The four-cylinder engine has been bored out to 1588 c.c. (95.06 cu. in.) and redesigned to take twin overhead camshafts and two double-choke, side-draft Weber carburetors. With a compression ratio of 9.5 to 1, the Lotus engine turns out 105 hp at 5500 rpm, with 108 ft.-lb. of torque at 4000 rpm.

This, in a car weighing only 1820 pounds, means lively performance for a small-engined sports sedan, with brisk acceleration in all gears and a top speed of 108 mph. Zero-30 took 3.8 seconds; 0-50, 7.4; 0-70, 13.1; 0-90, 32.7, and 0-100, 33.9. Ultimate speeds in the first three gears are 45, 70 and 94, but it would be more normal to shift up earlier, say at 5500 rpm, peak of the power curve.

Tractability is perhaps the most interesting feature of the engine and the car. Although it objects to lumbering along at 30 mph or less in top gear, it is very flexible for a high-g geared, open-road car, and not temperamental in traffic.

Performance is greatly assisted by a close-ratio gearbox. The floor-mounted gearshift is fun to use, except that it is too easy to go from first to top gear by mistake; the gate is too narrow. All four forward gears are synchromesh.

The individual front seats are well designed, giving good support on fast corners and a high degree of comfort on long journeys. Comfort is further increased by the ventilation system common to all Cortinas. Fresh air is blown into the car via aircraft-type directional vents on the panel, while stale air is extracted by other vents on the rear quarters. Fresh air can be directed at the face, and the interior of the car can be kept pleasant without opening any windows.

*(Please turn to page 38)*



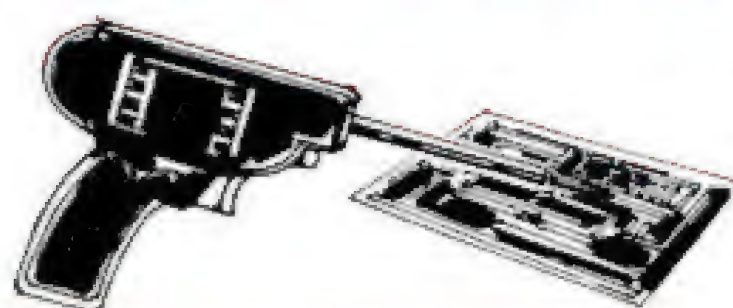
**LOTUS-CORTINA ROAD-HOLDING** is good in tight, high-speed corners. Body roll is quite pronounced



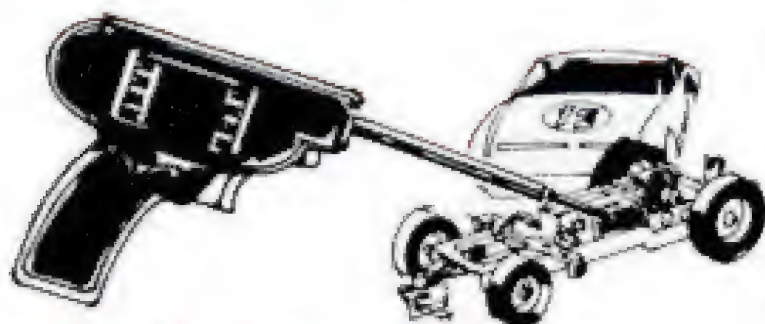
# HERE'S PROOF!



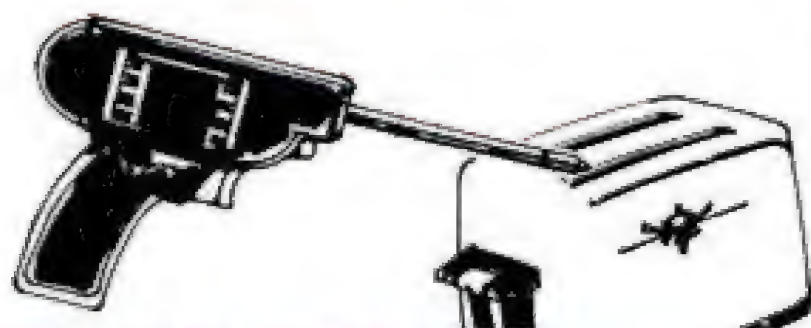
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## LOTUS-CORTINA

*(Continued from page 36)*

In general, the Lotus-Cortina is a pleasant, safe and easy car to drive. Yet there are many small (and a few big) ways in which it could be improved.

The steering (by recirculating ball) is accurate enough, but rather dead and, with high gearing and a small wheel, it takes a little time to get the feel of it.

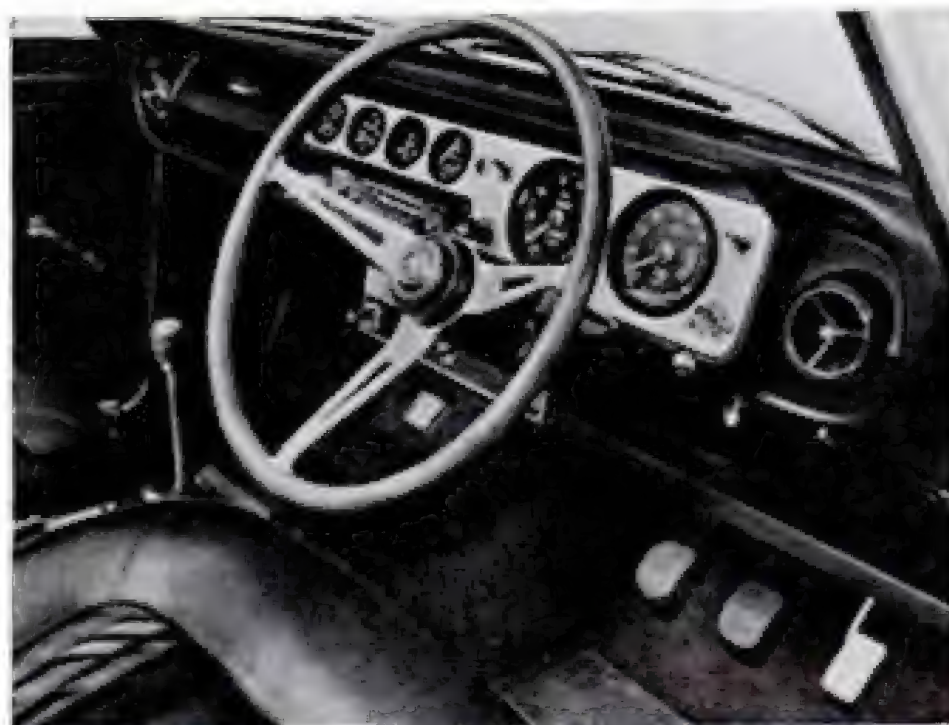
By contrast, the brakes are outstandingly light and powerful, with large front discs (drum rear) and servo boosters. They are so light, in fact, that it is easy to overbrake and lock the wheels. The handbrake is efficient, but unfortunately of the pull-and-twist type rather than the pull-up floor-level variety.

If close attention is paid to tire pressures, road-holding is good, though not outstanding for a car of this type. At Ford's recommended pressure for fast driving—22 lbs. up front, 27 rear—the ride was soggy. But at 26 and 32, respectively, the car sat on the road fairly firmly. However, the half-elliptical leaf springs at the rear soften up the rear to a disappointing degree and body roll is quite pronounced during hard cornering.

Aided by its considerable power, the car will corner rapidly and hold its line cleanly, especially if the throttle is used to help steer and balance it. But it is too easy to lose front-wheel adhesion on a wet or greasy road, when the car can become quite skittish.

For such a quick and sporting car, the Lotus-Cortina is not particularly thirsty. Driven hard most of the time, my test averaged a fraction over 22 mpg overall and I would not expect either gentler or rougher driving to alter this figure.

The car isn't cheap. It's \$3419 P.O.E., while the standard Cortina is \$1884. Performance, it seems, costs money. ★★★



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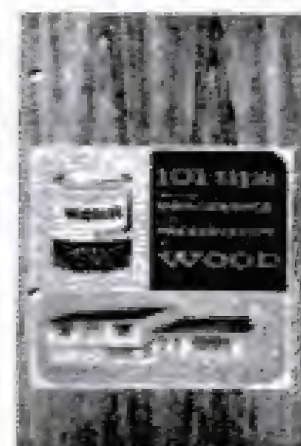
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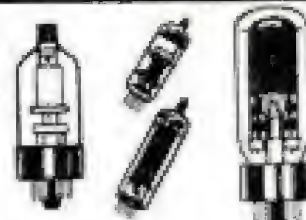
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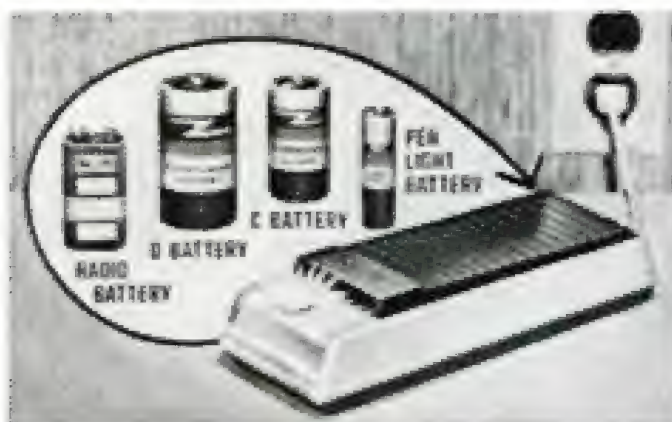
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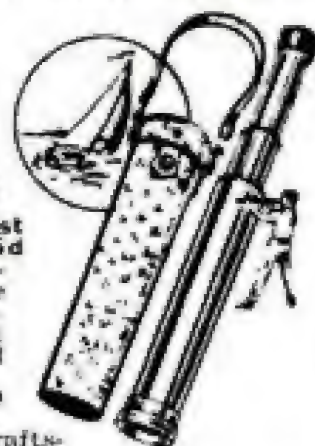
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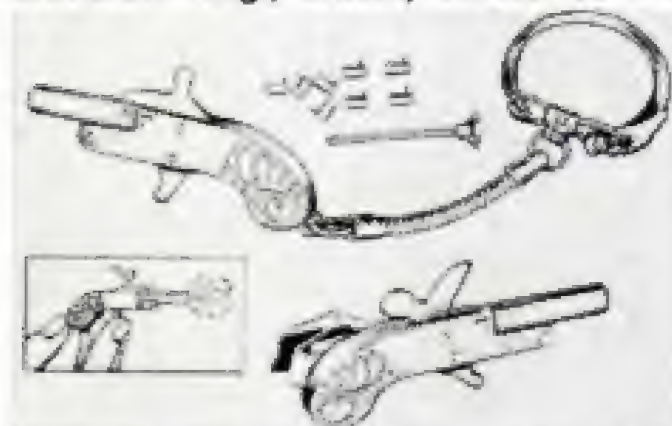
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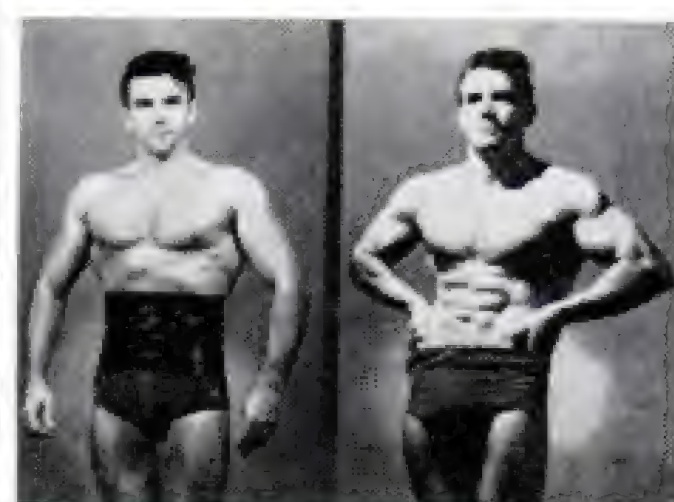
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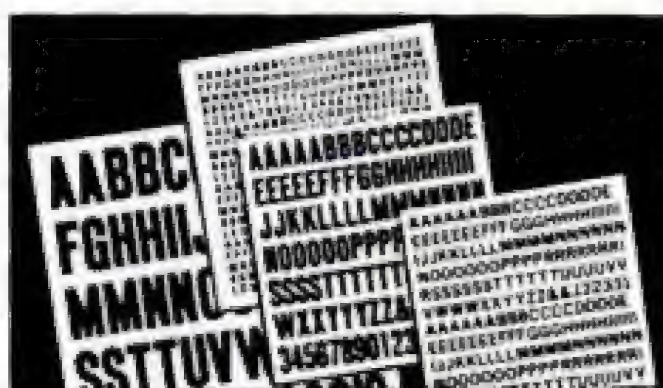
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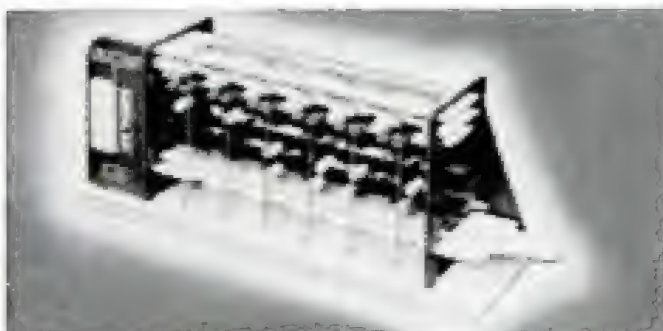
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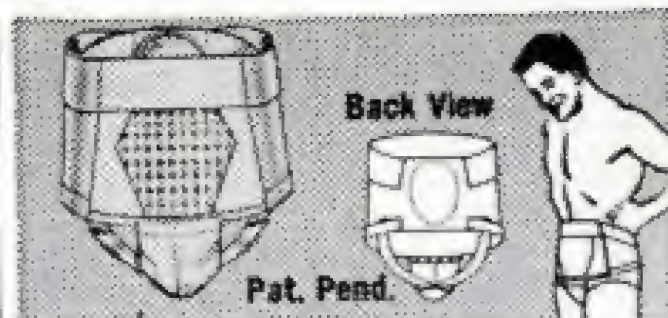
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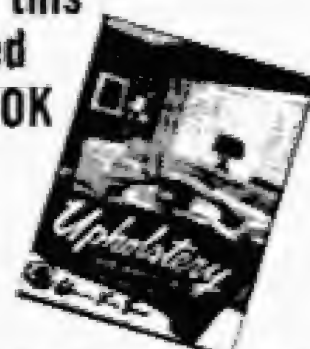
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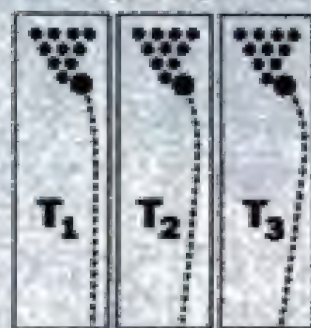
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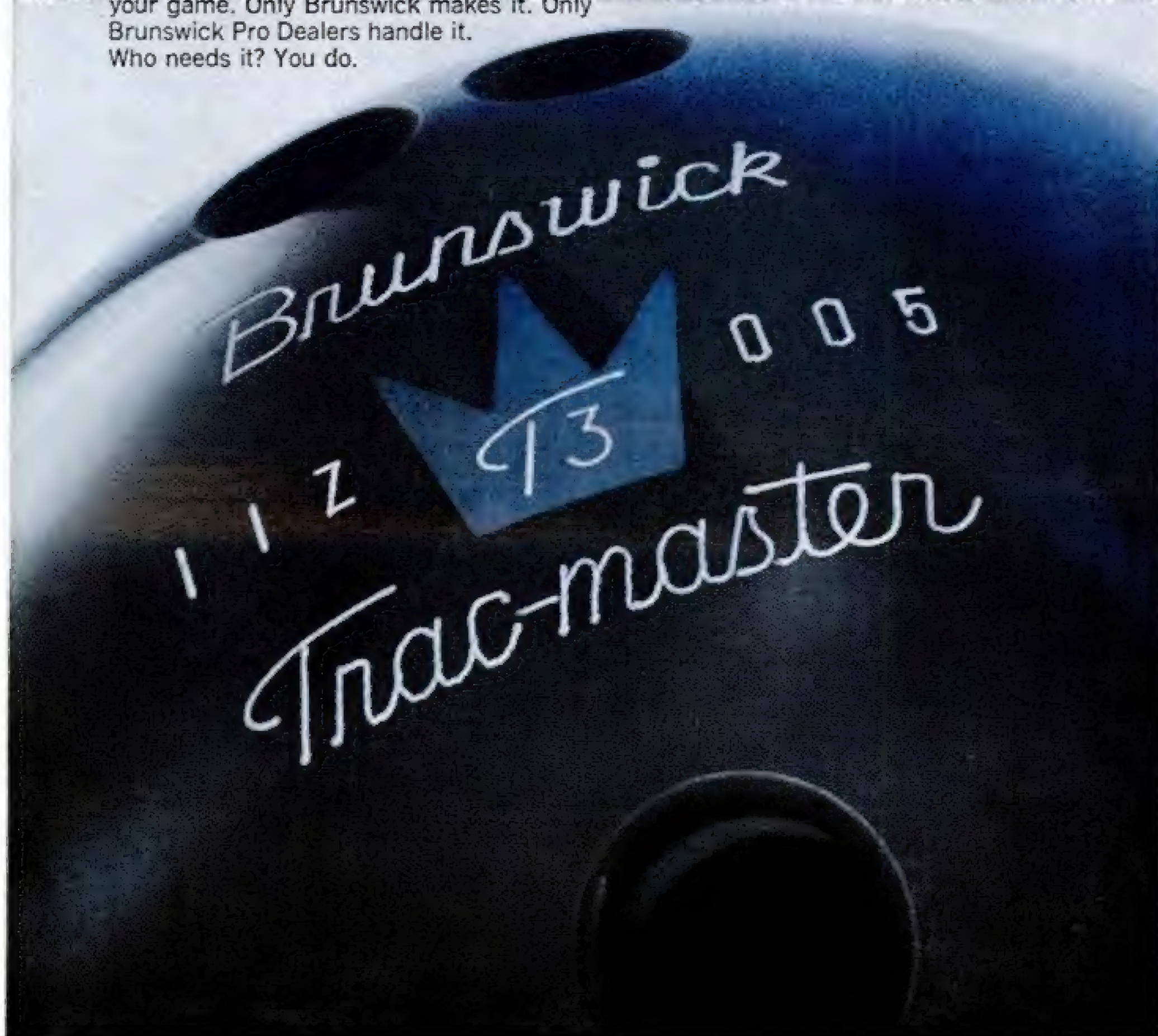
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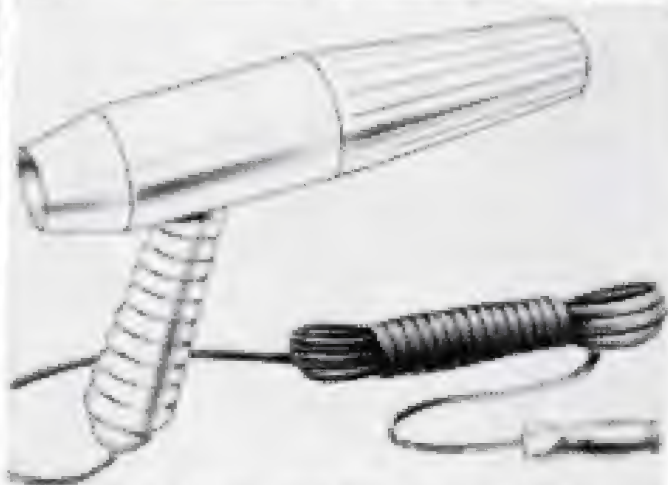
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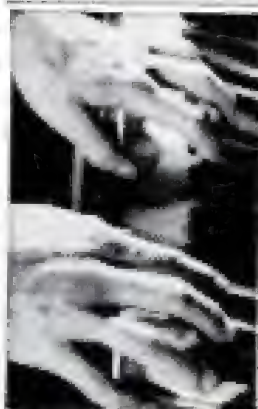
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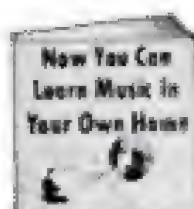
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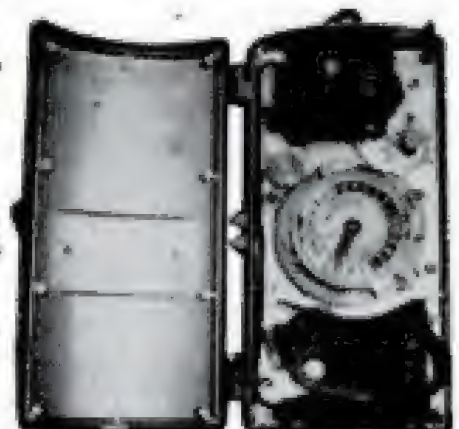
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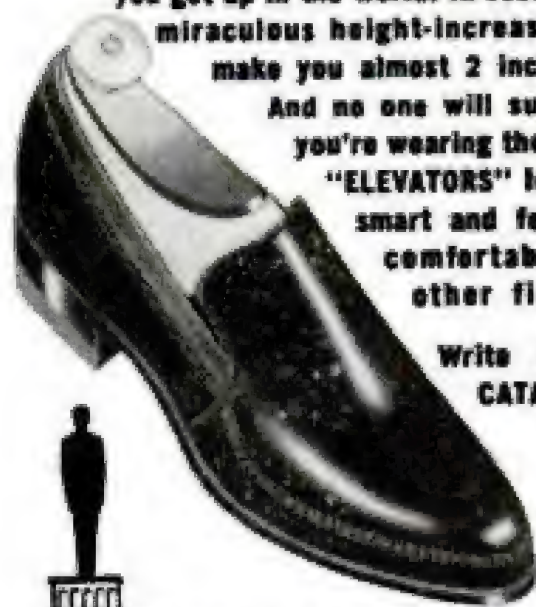




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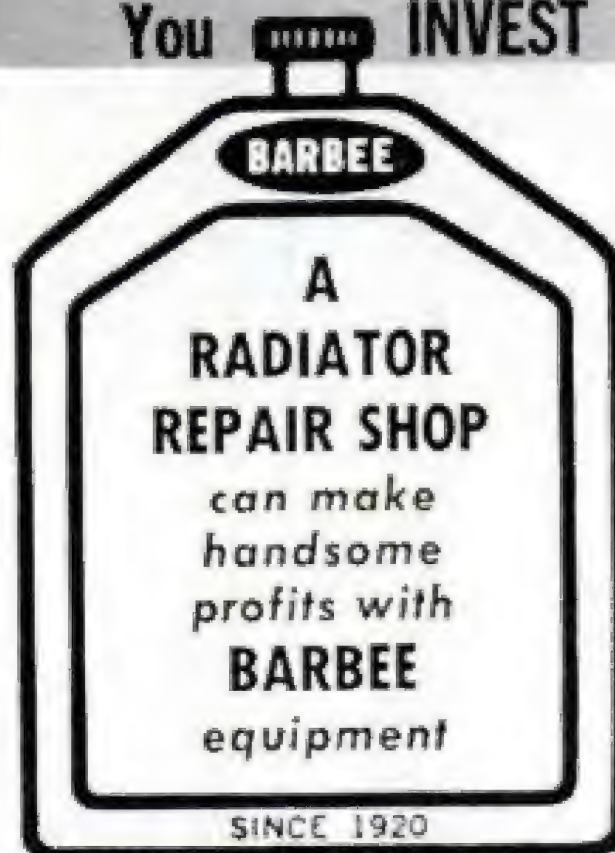
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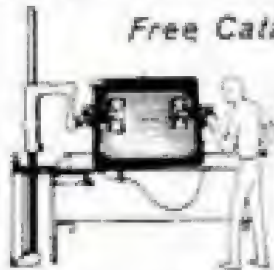


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BY KEVIN V. BROWN

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JETSTREAM

Flying boats may join the dinosaurs.

Another group has reached the end of the runway, or water slip. New Zealand's Air Force is phasing out its huge Sunderlands, which have patrolled the South Sea Islands waterways as reconnaissance and rescue aircraft for many years. Capabilities of modern aircraft, especially longer ranges, have obsoleted the water aircraft. But without an increased number of landing strips the need for water landings remains, especially in rescue work. There just aren't any new flying boats being built, however.

The Sunderlands are being replaced by land-based propjets.

Four views of the world—as seen by the eye, television, radar and infrared—are under study by the Air Force to improve cockpit display panels in fighter planes of the future. Seventy-five pilots took part in target recognition tests to determine viewing aids which will help identify ground-turn points and targets. Films of terrain photographed by the various sensing systems were projected on windshield, television, radar and infrared display panels. Pilots indicated time required to identify each target on a display or combination of displays. Scientists say results of the test will help evaluate man's ability to use two or more displays simultaneously.

Airline strikes produce hardships; also their share of humor. American Airlines, which was not affected by last summer's machinists' strike, absorbed many of the passengers from the five struck airlines and some of the tales the passengers told to get seats were very tall indeed.

One woman feigned pregnancy by stuffing a pillow under her coat. As soon as she was seated, she pulled the pillow out and handed it to the startled agent.

A death in the family was the usual gambit. New York ticket agents joked among themselves that there was no point going to California: "Everyone there is dead."

Mostly, however, passengers on standby adjusted amiably. Some businessmen, rather than lose their place in line, invited customers out to the airport to discuss deals. One enterprising beautician set up shop on his luggage and styled women's hair.



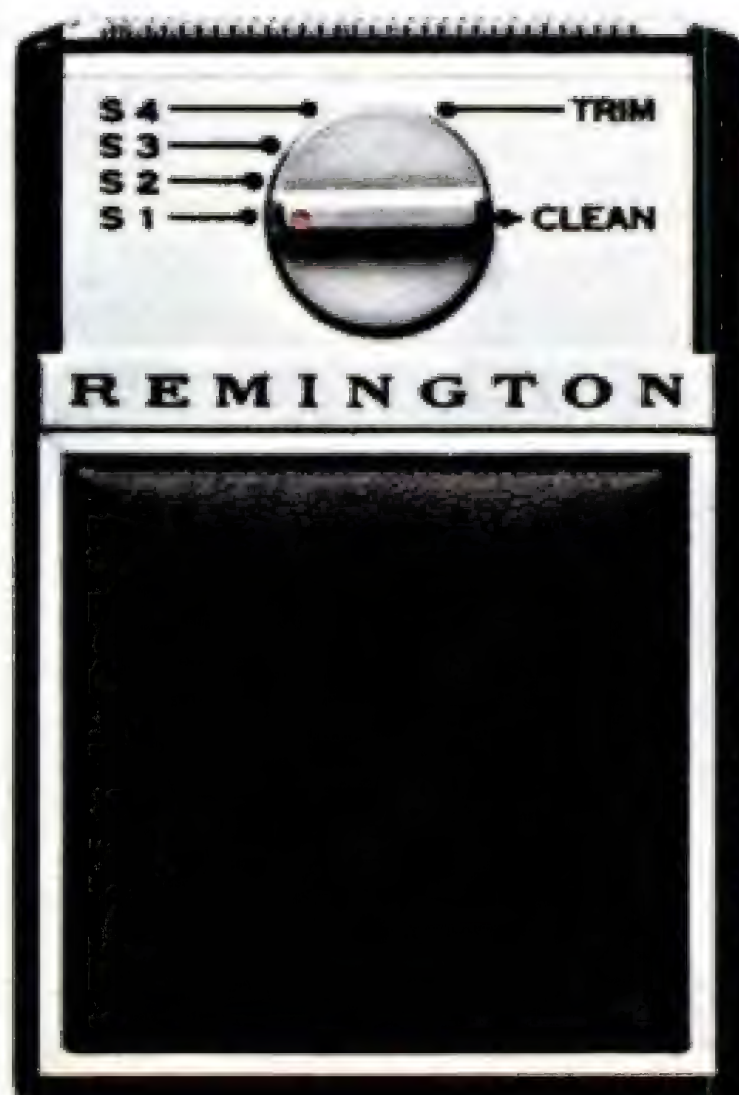
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# HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

## Light banishes mildew

One small closet in my home is in a corner of the room. There's no light in it and I can't keep clothing or shoes in this closet any time during the year: They mildew badly. I'd thought of installing a louvered door, but will it provide sufficient ventilation?—S.H., Fla.

A full-length louver door would help, except possibly when the humidity remains exceptionally high for long periods. Instead, it seems to me it would be best to install an outlet box at or near the baseboard level and connect it to the nearest branch circuit by whatever means approved by your local electrical code. Fit the box with a porcelain socket to take a 60- or 75-watt bulb controlled by a wall switch. The bulb at this low level should be protected against accidental breakage by a wire guard. Burning continuously during periods of high humidity, the lamp will provide sufficient heat to prevent the formation of mildew.

## Cracks a sign of settling

Due to job transfers, I've lived in three near-new homes in the past 10 years. In each one, a crack in the basement's concrete floor appeared running from the floor drain. In my present home, the crack is little more than a hairline, but it extends from the drain to the foundation wall. There's a slight seepage through this crack. Why does this happen? What's the best repair?—E.H., Colo.

Cracks that develop directly over floor drains are not common, but they do occur. The fact that you have lived in three homes where similar defects have turned up may be coincidental. All foundations of ordinary construction under homes of average size—even though they may have adequate footings—do settle, at least slightly. If the soil in the grade is more or less stable, settling usually is fairly uniform. If the drain line is some distance from the walls in both directions, the tile can act like a "fulcrum" over which the floor "breaks its back," so to speak. There could be other causes, but this is probably the most common. If the seepage is doing no damage, I wouldn't be in a hurry to repair the crack. Wait a while; it may

open further. If settling is the cause—and this is most likely—it will stabilize at some point. Then the crack can be repaired by cleaning it thoroughly with a stiff-bristle brush and then filling with a concrete patcher thinned to a pouring mix.

## De-wrinkling an old home

I live in an old "square," two-story house built in 1922. I'd like to make the outside a little easier on the eyes, as cheaply as possible. The siding is made up of narrow boards, still good, but the paint is in poor condition. The window sashes are poor. Across the front there are two windows upstairs, and downstairs, a double window at the left and a door at the right. A veranda extends across the front and around one corner. Can you make a few suggestions to start me off right?—I.N., S.D.

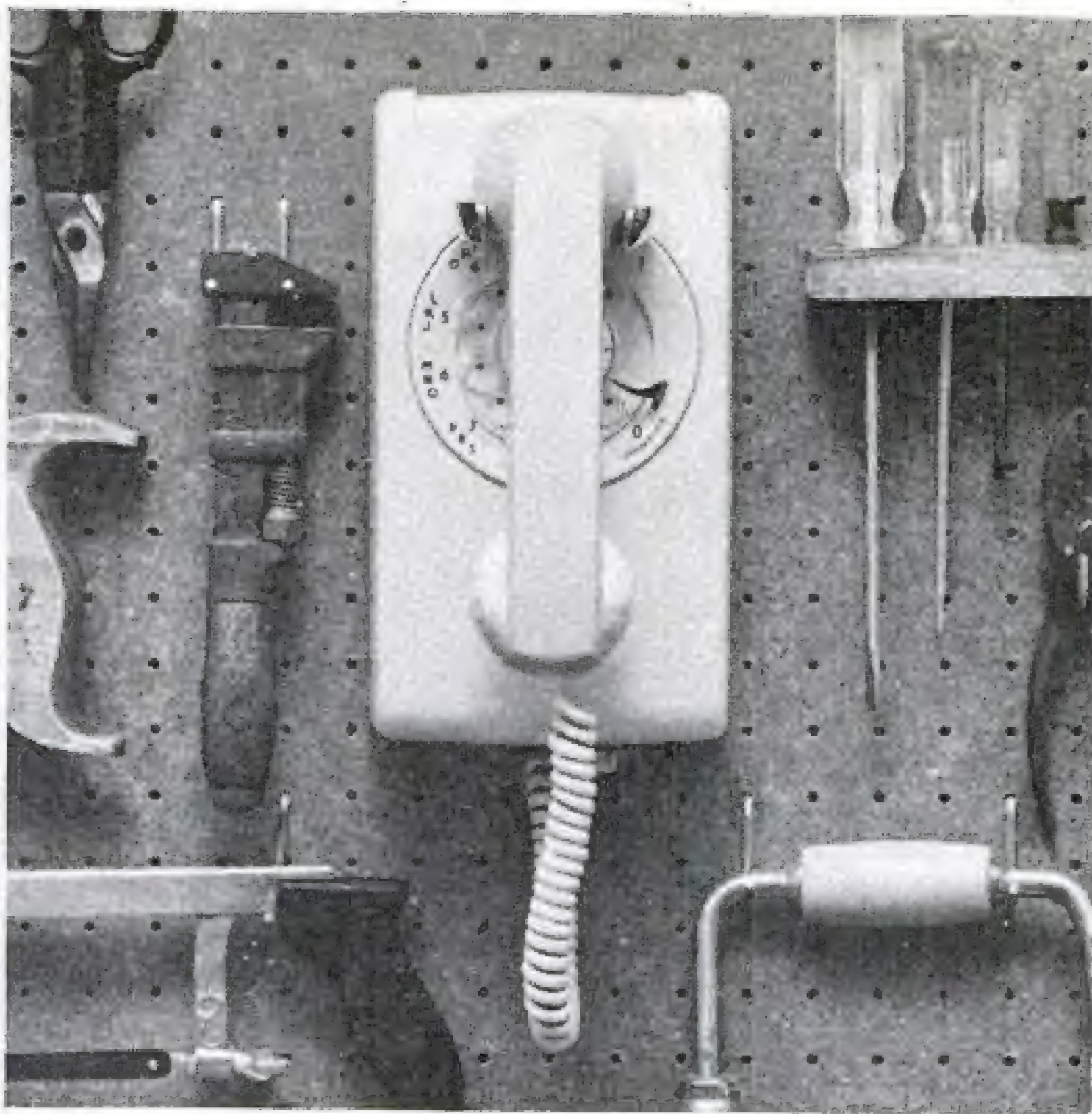
I hesitate to suggest remodeling at such long range. However, with only your description to go on I'll combine a number of assumptions and base suggestions on these. First, for the cosmetic effect, I would cover the old siding with aluminum siding in the color of your choice. Then install new multiple-pane sashes upstairs in front—or all around, if the originals are past reglazing—and a big dual-pane picture window on the first floor. Knock off the present veranda and install a new front door framed with a broken pediment. You can complement this with a wide concrete stoop with ornamental-iron railings. Make the stoop wide and deep enough so you can open the door without pushing your visitors down the steps. Clean and paint the trim in a mildly contrasting color and then as the final step, sweep the dirt off whatever of the foundation is exposed above grade and paint it to match the color of the siding. And there you are. Cost should be just about the minimum as remodelings go, and, as you say, it would be easier on the eyes.

## Pre-aging antiques

How can I reproduce that "old" black finish, or color, on iron antiques such as trivets, matchboxes and iron shelf brackets? Flat lacquers and other finishes just won't do it. The objects look new.—B.C., Va.

Clean the metal thoroughly with a wire bristle brush to remove the rust and dirt. Avoid handling them with bare hands—use a clean cloth. Then, dip the object in a strong photographic fixing solution and, when dry, coat with linseed oil (thinned with turpentine) to prevent rust.





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# SS 427

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**You want a sporting kind of engine.** In this case, it's a 385-horsepower 427-cubic-inch Turbo-Jet V8. Sometimes, when you're not busy, you just like to sit there and listen to it idle.

**You like a hood that bulges.** After all, you've got quite an engine under there. In fact, you like things distinctive and by its very markings, SS 427 stands apart from ordinary cars.

**You want your car to express you just so.** And happily, there's a long list of personalized touches you can add to the SS 427 — items like a new stereo tape system, front disc brakes.



**Everything new that could happen...*happened* in styling, safety, performance**





*You like to unwind.* So you really dig the SS 427's stiffer springs, shocks and front stabilizer bar. The red stripe tires and extra-wide rims they're mounted on help, too. All of this is standard.

*You're a safety-minded individual.* You like the idea of the new GM-developed energy-absorbing steering column on Chevrolets. Front seat belt retractors now standard.

*You especially appreciate a dual master cylinder brake system* — with a warning light to advise you of a pressure imbalance in either part of the system. Standard on all '67 Chevrolets.



New Chevrolet SS 427 Sport Coupe (Convertible, too) now performing at your Chevrolet dealer's.

**'67 CHEVROLET**





# CAREER BAROMETER

BY CREIGHTON PEET

As industries get bigger and more automated, it might seem that there are few spots left where a man is even occasionally left to his own devices to do a proper job. The fact is that the drivers of our 14 million trucks enjoy maximum independence and responsibility. Some are paid handsomely.

Truck driving can mean anything. It can involve dropping off two quarts of grade A at every other house along Main St.; going to the airport to pick up cases of fresh vegetables for a local merchant; racing a small panel job, whose racks are loaded with red-hot fashions from New York's garment district, to a department store in Chicago in time for a Monday morning sale.

Or it can mean pushing a powerful "double-bottom" reefer rig 95 feet long, carrying \$100,000 worth of fancy steaks from Chicago to Los Angeles. In the latter case, you and your partner hardly stop as you roll through wheat country, climb over the Rockies, and cross the desert to the West Coast. (A "double-bottom" is a

huge trailer around 40 feet long, hitched to a giant straight truck of similar size. A reefer is a refrigerated truck.)

While one of you drives, the other sleeps in the bunk behind the seat. (This is known as a "pajama wagon.") Or maybe you get a tanker loaded with dangerous acid—and a warning to take it easy. Or a contractor hands you a trailer loaded with a canvas-covered section of a rocket on its way to the moon, via Cape Kennedy.

No special education is needed to drive a truck, but many employers consider a few years of high school desirable and a good course in auto mechanics is valuable. Not only will it give you confidence, but it can save a lot of grief when you have a breakdown miles from a phone. In many jobs a strong back is important, when you have to make pickups and load and unload all types of merchandise—though some senior drivers carry assistants to do the lugging.

You usually start out small in trucking, like delivering Mrs. Jones' groceries or

*(Please turn to page 69)*

JOB TITLE	CURRENT NATIONAL DEMAND	STATES OR AREAS WITH SIGNIFICANT DEMAND	JOB TITLE	CURRENT NATIONAL DEMAND	STATES OR AREAS WITH SIGNIFICANT DEMAND
Aeronautical Engineer	652	Fla., Mo., Calif., Wash.	Mechanical Draftsman	320	N.H., Va., Ohio, Wis., Calif.
Aircraft Repairman	839	Conn., Calif., La.	Mechanical Engineer	1257	14 states, all areas
Air Pilot	581	Fla., Wash.	Metal Machinist, General	1364	10 states, all areas
Auto Body Worker, Transport, Equipment	632	N.C., Ill., Calif.	Metal Miller & Planer	387	Conn, N.Y., Ohio, Calif.
Carpenter	287	N.J., N.C., Calif., Wash.	Metal Turner	752	Conn., N.Y., Pa., Ohio, Ill., Calif., Wash.
Civil Engineer	385	D.C., Ohio, Calif.	Modelmaker: Patterns, Molds	830	Calif., Wash.
Computer Data Processor, Automatic	363	Mass., Ky., Ill., Wash.	Plumber, Gas Fitter, Steam Fitter	1151	11 states, all areas
Computer Programmer, Statistician	744	D.C., Ohio, Ala., Calif., Wash.	Policeman, Detective, Guard	1076	D.C., Fla., Mo., Calif., Ky., Ill.
Electrical, Electronics Engr.	1017	12 states, all areas	Radio-TV Assembler, Repairman	110	Ill.
Electrical, Electronics Tech.	570	Fla., Mo., Calif., Nev.	Sheet-Metal Worker	926	Conn., Fla., La., Calif., Wash.
Electrical Products Assembler	341	Conn., Mich., Calif., Wash.	Textile Machinery Repairman	371	Conn., Ill., N.J., Calif., Wash.
Electrical Equip. Assembler	169	Iowa, Calif.	Timber Cutter	498	N.H., Vt.
Electrical, Electronics Fabr.	223	N.M., Calif., Wash.	Toolmaker	2252	10 states, all areas
Electronics Assembly, Repair	243	N.H., Ill., Minn.	Transport. Equip. Assembler	2697	12 states, all areas
Lighting Equip., Bldg. Wirer	319	N.J., Minn., Mo.	Transportation and Material Handler	480	Mass, Ohio, Mo., La., Calif., Wash.
Machinist	2737	15 states, all areas	Welder	1590	14 states, all areas
Marine Equipment Repairman	244	Mass., N.H., Calif.	Wire Communication Assembler	238	N.C., Fla., Ill., Cal.
Mathematician	230	N.Y., Calif., Wash.			

PM'S CAREER BAROMETER CHART, above, gives the actual number of job openings listed with state employment agencies by various industries. They do not represent all jobs available, but relative demand is reflected. "Current Demand" figures are true as of our closing date. Check this chart each month and it will tell you where your talents are needed, and how badly. For names of actual

employers represented by these listings you must apply in person to the state employment agency in the capital city of the state indicated.

Today, with proper schooling, you can qualify for many of the job categories shown. For a list of accredited correspondence and residence schools, write to PM's INFORMATION BUREAU, 575 LEXINGTON AVE., N. Y. 10022.



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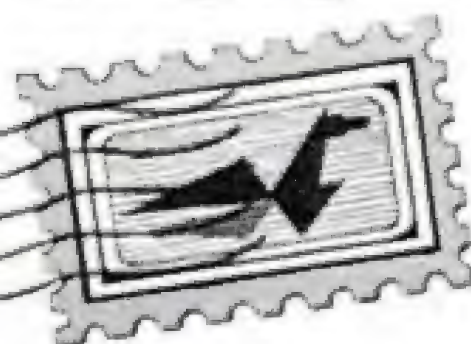
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# CAREER BAROMETER

(Continued from page 66)

driving a school bus. As you get older people trust you with more complicated machines. Local drivers make about \$3 to \$3.50 an hour, but rates vary widely. For example, in Atlanta, milkmen make around \$95 a week, while those in San Francisco get over \$141.

Because the equipment that an over-the-road man handles, and the cargoes he carries, are often valuable, big trucking outfits usually want men over 25 who have passed rigid physical examinations and have perfect eyesight—with or without glasses. They may also give prospective drivers road tests and written exams. They want to be absolutely sure of your skill, your character and your stability.

Very often you are on your own for days at a time and the responsibility is terrific. You may run into foul, difficult weather and breakdowns, but the shipper wants his merchandise delivered on time—and so does your boss. A heavy rain can wash out a piece of road or cover it with boulders which could turn you into a ditch. You may meet holdup men in lonely spots, just like the stagecoach drivers on TV. In fact, the pilot of a \$25,000

tractor-trailer and its valuable cargo—he must keep a daily log book just like a ship's captain—is leading one of the few adventurous lives left in the United States.

It's a touchy, exhausting business. Often you are away from home a week or two at a time. Night driving is hard on the eyes and nerves. While the ICC insists that a man must have 8 hours of rest after 10 on the job, things may work out so that a man is with his truck as much as 100 hours at a time, catching four-hour periods of sleep in the bunk to keep up with the ICC requirement. Men on intracity moving vans really sweat when they pick up and deliver furniture, but drivers of the big cargo rigs usually drop their trailers at a terminal for local men to unload, spend the night at a hotel (at company expense), then start out the next day with a different trailer.

The pay is good. Over-the-road men may start at \$150 a week, but a great majority make \$10,000 a year. Some make \$12,000 or more, with all the usual fringe benefits. And a "driver-salesman," in beer distribution for instance, may run his take to more than \$20,000 if he's a good salesman and runs up his commissions in a good territory. ★★★

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Will automation take my job?  
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Could I succeed as my own boss?  
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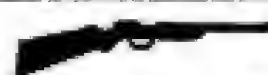
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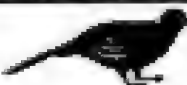
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**POWERFUL** Metrotech locators detect gold, silver, coins, relics. Moneyback guarantee, terms. Free information. Underground Explorations, Dept. A, Box 793 Menlo Park, California.

**TREASURE**, Gold, silver, relics. New 1966 detectors now available. Free information. Rayscope, Box 715, North Hollywood, California.

**SAVE!** Build transistorized treasure finder. Details free. Del Research, Box 436B, Centerville, Georgia 31093.

**NEW** Revolutionary selective transistorized metal detector. Push button tuning automatic tuning, etc. Many models. Free catalog. Gardiner Electronics Co., Dept. 9, 4729 N. 7th Avenue, Phoenix, Arizona 85013.



NEW 1966 Goldak treasure, coin, gold, silver locators, Goldak, Dept. PMC, 1544 W. Glenoaks, Glendale, Calif. 91201.

FIND Buried coins, treasures, relics. New supersensitive, low priced models for land or underwater use. Free information. Sensitronix, 2225-C, Lou Ellen, Houston 18, Texas.

### PRECIOUS STONES AND MINERALS

CATALOG Free. 12 Uncut gemstones—amazonite, amethyst, apatite, corundum, emerald, garnet, opal, orthoclase, peridot, sapphires, sunstone, zircon. \$2.00 postpaid. Satisfaction guaranteed. Hill's, P.O. Box 7364-A, Salem, Oregon.

GET Free catalog no serious rockhound, gem cutter, jewelry maker, hobbyist or craftsman can be without. Full of bargains, exclusive items, low prices from largest suppliers and authorities in the field. Free new catalog just off the press, yours for the asking. Write Grieger's, Dept. C-12, 1633 E. Walnut, Pasadena, California.

100 COLORFUL, Polished gemstones. \$1.00. Tumblecraft, 5401 James North, Minneapolis, Minnesota 55430.

SEMI-Precious uncut gems. Ten different for \$1.00. Request list 30, Prospectors Shop, 201 San Francisco, Santa Fe, New Mexico.

EARTH Science Rockhound Magazine. Subscription \$2.50. Sample 35¢. Box-550-PM, Downers Grove, Ill. 60515.

TURQUOISE Nugget key chain plus 175 page rockhound catalog \$1.00. Many pages in full color showing thousands of cut gemstones, mountings, gemstone rough from around the world and all supplies necessary to make jewelry for profit or fun. It's easy! Gemex Co. Dept. PM, Hwy. 76, Pala, California 92059.

CRYSTALS, Minerals, gemstones. Worldwide localities. New arrivals listed each month. Lists free. Sering, 1705 E. Michigan, Indianapolis, Indiana.

### CARTOONING, COMMERCIAL ART, SHOWCARD & SIGN PAINTING, TATTOOING

PROFESSIONAL Cartooning instruction by mail. Free booklet "Successful Cartooning" gives course details and opportunities. National School of Cartooning, Studio-H, Box 8958, Cleveland, Ohio 44136.

"GAG" Cartoons for money! Magazines spend millions yearly for funny ideas. Home study course trains you to cartoon your ideas professionally. Send only 25¢ to cover cost of mailing and handling for sample lesson and details. State age. Evans School, Box 57, Dept. PM, Brookfield, Illinois.

WANTED—Cartoonists, Amateurs, professionals. Over 200 markets. Information Free. Markets-4-116, 11620 Lansdowne, Detroit, Michigan 48224.

SHOWCARD & SIGN PAINTING TATTOOING CARTOONERAMA Teaches you cartooning in a 24 lesson course. Free brochure. CPA, Box 263-2A, Branford, Connecticut 06405.

LEARN Profitable magazine cartooning. Free details. Hartman, Box 3097, Lincoln 10, Nebraska.

CARTOONING And commercial art. Easy home-study drawing course. Art background not necessary. Excellent creative money making opportunities part or full time. We show you how. Low monthly tuition. Free booklet. Continental Schools, Dept., 6A-23, 1330 W. Olympic Blvd., Los Angeles, Calif. 90015.

"HOW To Make Money With Simple Cartoons"—Everyone who likes to draw should have this book. Free. Send name, zip code. Cartoonists Exchange, 911 Pleasant Hill, Ohio 45359.

SIGN Painting. Fascinating system. Straley, 410 South Western, Springfield, Ohio.

YOU Can entertain with chalk talks. Catalog 10¢. Balda the Cartoonist, Oshkosh, Wis. 54901

LEARN Sign painting at home. Free talent test. Ben Kerns, Box 812-PM, Greenville, S.C.

### ADVERTISING AGENCIES, ADV. SERVICE, MAILING LISTS

GET Volume mail orders for your offer... from 41 mail-producing magazines delivering responsive prospects by the millions. Amazing low-cost. Hundreds of classified ads scheduled regularly, profitably. Free Details. Classified, Inc., Dept. PM-1, 100 E. Ohio, Chicago 60611.

ADVERTISING Ratebook leading newspapers, magazines, free. Chicago Advertising Agency, 28-E Jackson, Chicago 4.

MAILING Lists most all kinds 1000 \$5.00. Free folder. Your circulars mailed \$4.00 1000. Dixie Mailers, King, N.C. 27021.

MAILORDER Record Book, 30 pages. Records inquiries, orders, advertising expense, etc. Most complete. Just send dime for postage and handling. C. A. Martin, Popular Mechanics, Dept. RB11, 575 Lexington Ave., New York, N.Y. 10022.

### TYPEWRITERS, DUPLICATORS, OFFICE EQUIPMENT

OFFSET, Letterpresses, varitypers, typewriters, mimeograph, multigraph machines. Bargains. DixieGraph, King, North Carolina 27021.

### RUBBER STAMPS AND OFFICE SUPPLIES

SAVE MONEY With quality rubber stamps. Complete line. Write: Nolan's, 1293C Trapelo, Waltham, Massachusetts 02154.

FREE Catalog: Rubber stamps, printing. Dowling Products, Dept. PM36, Pitts-town, N.J.

FREE 32 Page rubber stamp catalog. Signature stamps \$3.50. Youngers Stamp Shop, Princeton, Iowa.

### PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

EMBOSSER Business cards, \$2.99/1000. Free samples. Gables, 405A Clifton, Glen-shaw, Pa. 15116.

OFFSET Printing 250 copy \$3.44 Postage paid. Haycraft Printing, 1220 Mt. Vernon Dr., Bloomington, Illinois 61701.

FREE Booklet—"Secrets of Cutting Printing Cost." Cisco's, Atlanta, Illinois 61723.

OFFSET Printing 25 to 5,000 copies 24 Hour service. Low prices. Cisco's, Atlanta, Illinois 61723.

SAVE Money by using mimeoprinting. Details free. News Messenger, South Lancaster, Mass. 01561.

1000 RAISED Letter business cards. \$3.50. Eldee Press, Allendale, N.J.

AMAZING Business printing values. Samples. Print Shop, Box 576, Greenville, R. I. 02828.

QUALITY Printing: Lowest prices. Samples. Dowling Press, Dept. PM-36, Pitts-town, N.J.

1,000 THERMOGRAPHED (Raised letter) business cards, \$3.75. Free samples! Griffin, 322 West State, Ithaca, New York 14850.

1000 GUMMED Address labels, \$1.00. Walt's, Box 966-A, South Bend, Indiana 46624.

### PRINTING & RUBBER STAMP OUTFITS—SUPPLIES

CATALOG: Rubber stamp equipment, supplies. Martin, 1425S Major, Jefferson City, Missouri 65101.

RUBBER Stamp presses, hydraulic operated, electrically heated. Sizes 5" x 8", 8" x 12", 10" x 15". Starting outfits, supplies. Printing Presses. Orders presses, supplied shipped day received. 1966-67 catalog low supply prices. Custom Manufacturing, 402-P East Elm, Springfield, Missouri.

TYPE Catalog No. 11, 96 Pages. Send One Dollar. Deductible First Order. Acme Type, 732 Federal, Chicago, Illinois.

TYPE And supplies for rubber stamp makers. New wholesale price list No. 3 free. Star Stamp Supply, 732 Federal, Chicago 5, Ill.

RUBBER Stamp presses, hydraulic operated, electrically heated. Sizes 5" x 8", 8" x 12", 10" x 15". Starting outfits, supplies. Printing presses. Orders for presses and supplies shipped same day received. Custom Manufacturing, 402-P East Elm, Springfield, Missouri.

RUBBER Stamp outfits, supplies. Kiewiet, 2025 Barney Road, Kalamazoo, Mich. 49007.

RUBBER Stamp manufacturers supplies. New products. Low prices. Catalog. Jackson Supply, 1433 Winnemac, Chicago, Illinois 60640.

MAKE Your own self-molding rubber stamps and printing cuts. Plexirubber, Argyle 1, Wisconsin.

PRINTING Presses, type, supplies. Lists, 5¢. Turnbaugh Service, Mechanicsburg, Pennsylvania.

DO Your own printing. Save money. Simple rules. We supply everything. Print for others: good profit. Raised printing like engraving too. Have home shop. Details free. Kelsey Presses, V-11, Meriden, Connecticut.

### REMAILING SERVICE

CANADIAN Address. Details, 10¢ Moore's, Box 37, Wasaga Beach, Ontario, Canada.

NEW York remailings, 25¢. Florida, 25¢. Puerto Rico, 50¢. Mexico, Spain, France, \$1.—Valles, Box 761, New York 10008.

DALLAS Texas remails 25¢. Box 9912, Dallas, Texas 75214.

FAST, Professional remailing. Many services. Write: Rucker, 909 Buena, Chicago 60613.

CAPE Canaveral—Confidential remailing, receiving. Free details. 25¢ Single, \$3.00 monthly. P.O. Box 355, Cape Canaveral, Florida.

EFFICIENT, Reliable, confidential, 25¢ each, \$3.00 Monthly. Complete remailing service. Information free. Carpenter, Box 892, Syracuse, N.Y. 13201.

MEXICO Re-airmails. Forwarding, receiving, \$1.00. Postcards. Kaylu, Apartado 669, Guadalajara.

REMAILS 25¢. Monthly, \$3.00. Saint, 3546 Edgewater, Orlando, Florida 32804.

LAS Vegas remailing 25¢ single; \$3 Monthly. King Sol, Box 4208, North Las Vegas, Nevada, 89030.

"FROM Fabulous Las Vegas. Unexcelled, fast, dependable, confidential service. Remails, 25¢. Monthly rates. Colorful cards. Ruthie, 558 Oakley Blvd., Las Vegas, Nevada.

REMAILS. Forwarding, receiving. Since 1958. Ellis, 407-PM Washington, Fairfield, Illinois.

TUCSON—Confidential, 25¢ single, \$3. monthly. Sterling, Box 4481-PM, Tucson, Arizona.

BROOKLYN Re-mails 25¢ per letter, \$3.00 monthly plus postage. Krause PM, Box 197, Flatbush Station, Brooklyn, N.Y. 11226.

SECRET Mail receiving system. Complete business services. Harvey, 35124 Euclid Ave., Suite 202-H, Willoughby, Ohio 44104.

HAWAII Secret Address. Remails 25¢. Receiving-forwarding \$3.00 monthly. Postcards, gifts, slides. Uppie, Box 984, Kailua, Hawaii 96734.

REMAILING: Fast! Many services. Free details. Rucker, 909 Buena, Chicago, 60613.



**TIMELY** Remailing 25¢. Unlimited Monthly \$3.00. Confidential. Postcards. Schoen, Box 1963-P, Chicago, Illinois 60690

**SECRET** Mail receiving system. Hedgpeth, 406-M South Second, Alhambra, California 91802

**SECRET** Receiving and remailing. Discreet and confidential. Remail 25¢ single. 8050 S. Main, Houston, Texas.

**COMPLETE**, Confidential remails, 25¢ single, \$3.00 monthly. Bill, Box 1788, Phoenix, Ariz.

**MIAMI** Remails 25¢. Monthly Rates. Marie, P.O.B. 1266, Coral Gables, Florida 33134.

**LOS ANGELES**, Hollywood, San Fernando Valley—25¢ single; \$3.00 monthly. Confidential, 10437 Lanark Street F, Sun Valley, California 91352.

**N.Y.C.** Remailing, 25¢. \$2.00 monthly. Williams, 2100 Mapes Ave., Bronx, 10460.

**SO. AMERICA** Registered re-airmails, \$1.00. Confidential, reliable. Genaro, Box 360, Guayaquil, Ecuador.

## REPAIRS AND SERVICING

**YOUR** Ad in this space will be read by more than 1,400,000 active mail order buyers. Join the march to greater profits, place your products and services in front of them today with a small low cost classified ad. For further details, write: C. A. Martin, Dept. 15N, Popular Mechanics, 575 Lexington Avenue, New York, New York 10022.

## SPECIAL SERVICES

**INFORMATION** Any subject. Products, books, people, business. \$2.00. Box 5996, Reno, Nevada 89503.

**INFORMATION** On anything. Ferguson Research Specialists, 83-45 Victor Ave., Elmhurst, N.Y. 11373.

**LOCATING** Service! Any item or product. Jake Barraco, 478 Gardner, South Beloit, Illinois 61080.

**WE** Locate anything you need for a reasonable fee. NBARS, 9325H, Menard, Oaklawn, Ill. 60453.

## TOBACCO

**PREMIUM** Tobaccos. Save 10 to 35 percent. Buy direct. Send \$2.20 for six sample pouches. No C.O.D. Prepaid. Maine Guide Tobacco, R.F.D. 2, Gorham, Maine 04038.

## RAZORS

**RAZOR** Blades—10 Swedish stainless double edge \$1. Blades, Box 16026, Cleveland, Ohio 44116.

## WANTED—MISCELLANEOUS

**PROMINENT** Toy Mfg. seeking new toy ideas suitable to nationwide television promotion. Financial arrangement open. Write: Toys, Box #574, Norwood, N.J.

**MERCURY**, Gold, Silver, Platinum; Ores assayed. Wholesale Terminal, Norwood, Mass.

## PERSONAL

**BORROW** With Confidence! Over 50 years of experience. Loans by mail, \$100 to \$1000. Budget Finance Co., Dept. PB-010C, 317 South 20th, Omaha, Nebraska 68102.

**NEED** Money? Borrow \$100 - \$1000 by mail. Confidential. Repay in 36 months. Free loan application. American Loan Plan, Dept. PA-010A, City National Bldg., Omaha, Nebraska 68102.

**PAY** Bills! Have cash left over, \$39.39 repays \$1000 in 36 months. Write for details. World Finance Co., Dept. PW-010B, 620 Symes Bldg., Denver, Colorado 80202.

**BORROW** \$1,205 Airmail! Repay \$47 for 36 months. State licensed. Postal Finance, Dept. 17-T, 200 Keeline Building, Omaha, Nebraska 68102.

**RUPTURED**. Relief and comfort. No understraps, elastic or steel. Write Hand-Lock Products, Preston 4, Ont., Canada.

**DEBT** Escape—Easy "no-risk plan." Immediate relief. Free details. Counselor-7, Harlingen, Texas 78551.

**NEED** Money? Your debts too big. Solutions to all financial problems. Amazing results. Free details. Licensed and bonded. Write Financial Consultants, 28 E. Jackson, Suite 1204-PM, Chicago 60604.

**EYE** Exercise instructions. US \$1. Foreign \$1.25. Eyeco, 522 Jordan Lane, Huntsville, Alabama.

**EXCITING** Illustrated book. Funny old sayings. \$1. (P) Publishers, Dayton, Virginia 22821.

**BLITZ** Reducing! 5 pounds overnight! Guaranteed! Bijou, Box 1727-BM, Hollywood, California 90028.

**BIBLE** Questions answered. Stamped envelope. Bylon, 17167 Bentler, Detroit, Michigan 48219.

**SUBCONSCIOUS** Conditioning remakes personality while you sleep. Free details. Sleep-Learning, Box 24N, Olympia, Washington.

**LOW-Cost** loans by mail, \$6.00 monthly repays \$104.50; \$56 monthly repays \$1,321.39. Borrow any amount. Guaranteed fast, confidential. Write today! Bankers Investment, 67-D, Box 1648, Hutchinson, Kansas 67501.

**BILL** Problems? Poor credit no trouble. Not a loan company. Send for free application. Automatic Acceptance, 307PM P-casset Ave., Providence, R. I. or 318PM Broadway Blvd., Reno, Nevada.

**LOANS** By mail, \$100-\$1000. Anywhere. Confidential. Write Union Finance, Dept. PM, 222 W. Osborne, P.O. Box 7457, Phoenix, Arizona.

**LOW** Cost loan? Solutions to all financial problems. Non-lending plan. Amazing results. Free details. Write Financial Consultants, 28 E. Jackson, Suite 1204-PM, Chicago 60604.

**BORROW** \$100 to \$1000 by Mail, Quick, Easy, Private. No Co-Signers. Repay in 36 small monthly payments. For the amount you want write today to Dial Finance Co., 410 Kilpatrick Bldg., Dept. 11-214, Omaha, Nebraska, 68102.

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**"SLEEP** Learning tapes". Write for free brochure. "What's it all about." Personalized Tapes, Box 190-PM, Quincy, Massachusetts 02169.

**INVESTIGATORS**. Free brochure. latest subminiature electronic surveillance equipment. Ace Electronics, 11500-P NW 7th Ave., Miami, Florida 33168.

## MISCELLANEOUS

**1905-1950**. POSTCARD Letter. Your birthday cancellation, \$1.00. Searcy, 1621 SE 139, Portland, Oregon 97233.

**BUMPER** Stickers: Merry Christmas: season's greetings; Humbug! 2/1, Box 2255K, Culver City, Calif. 90230.

**"HOW** To build a still". Humorous, factual, illustrated. 50 Pages. Includes distillation, fermentation, wine, homebrew, taxes, etc. Over 25 recipes. \$2.00. Buze, Box 490, Norman, Oklahoma 73069.

**UNUSUAL** Gifts and novelties. Free catalog ideal for Christmas. Fort Wayne Mail Order, Box 846, Fort Wayne, Indiana 46801.

**4-COLOR** Lead pencils \$1.00 post paid **LEADS** READILY AVAILABLE. Gift boxed with extra set of lead, one dollar twenty five. Marval International, 31 Donald St., Clifton, N.J. 07011.

**REVITALIZE** Yourself with a mineral bath! 8 Active minerals in 2-ounce individual mineral bath packages, 3/1.00 or \$3.50 dozen postpaid. Century Enterprises, 6311 Yucca Street, Hollywood, California 90028.

**NYLON** Marking pen, 50¢. Ward, 40 Park Ave., Pompton Plains, N.J. 07444.

**SAVE** Money! Make your own home brew! Complete Instructions, \$2.00, Box 135, Ft. Wingate, New Mexico 87316.

**WHAT** DID YOU MISS in June issue P-213, Efenbee Co.

**DREAMBOOK**—1,316 Dreams and their meanings, fortune-telling, charms. Only \$1.00. Suskind, Box 395, New York N.Y. 10019.

**LOG** Cabins: Ship anywhere: 35 plans, specifications and prices. Send \$1.00. Write Bloch Brothers, Waterford 4, Michigan.

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**KILL** Mosquitoes, crop destroyers. Electronically. Free information. Box P, 204, Metamora, Michigan 48455.

**YOUR** Name sent to 1000 importers, publishers, mailers, wholesalers, etc. on our mailing list. Year \$1.00. Dixie Mailers, King, N. Car. 27021.

**WINEMAKERS**, Free illustrated catalog of yeasts, equipment. Simplex, Box 7208, Minneapolis, Minn. 55412.

**HEARING** Aid batteries wholesale. Free list. Habs, Box 51, York, Penna.

**BOOKS** On antiques and their prices. Free circular! P. Warman Publishers, Uniontown, Penna.

**SUPER** Memory overnight! Success guaranteed! Bijou, Box 1727-M, Hollywood 28, California.

**VENTRILOQUISM!** Information free! Dummy catalog, 25¢. State ave. Maher, Studio J, Box 36, Kensington Station, Detroit 24, Michigan.

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**30 BALLPOINT** Pens retractable. Fully guaranteed, \$1.00 postpaid. Marsan Associates, Box 409, White Plains, N.Y.

**MONITOR** Telephone conversations! Unnoticed! Supersensitive listen-in device! No telephone connection required! \$3.95 (guaranteed). Interstate Products, Box 1-7G24, Pelham, New Hampshire.

**LISTEN-In** device! Supersensitive! Powerful! Monitor telephone conversations! Unnoticed! \$3.98 (guaranteed). Research Enterprises, 29-SN4 Samoset, Woburn, Mass.

**FREE** Gift catalog. Pera, Box 1837 P, San Francisco, Calif. 94101.

**TRACKSPEED** Thoroughbred racing computer. A-Box 16042, Long Beach, California 90806.

## CHRISTMAS GIFT SHOPPING

**CHRISTMAS** Kit, decorations, gifts, recipes. Send \$1.00. Swimm's, RR4, Box 4, La Porte, Indiana 46350.

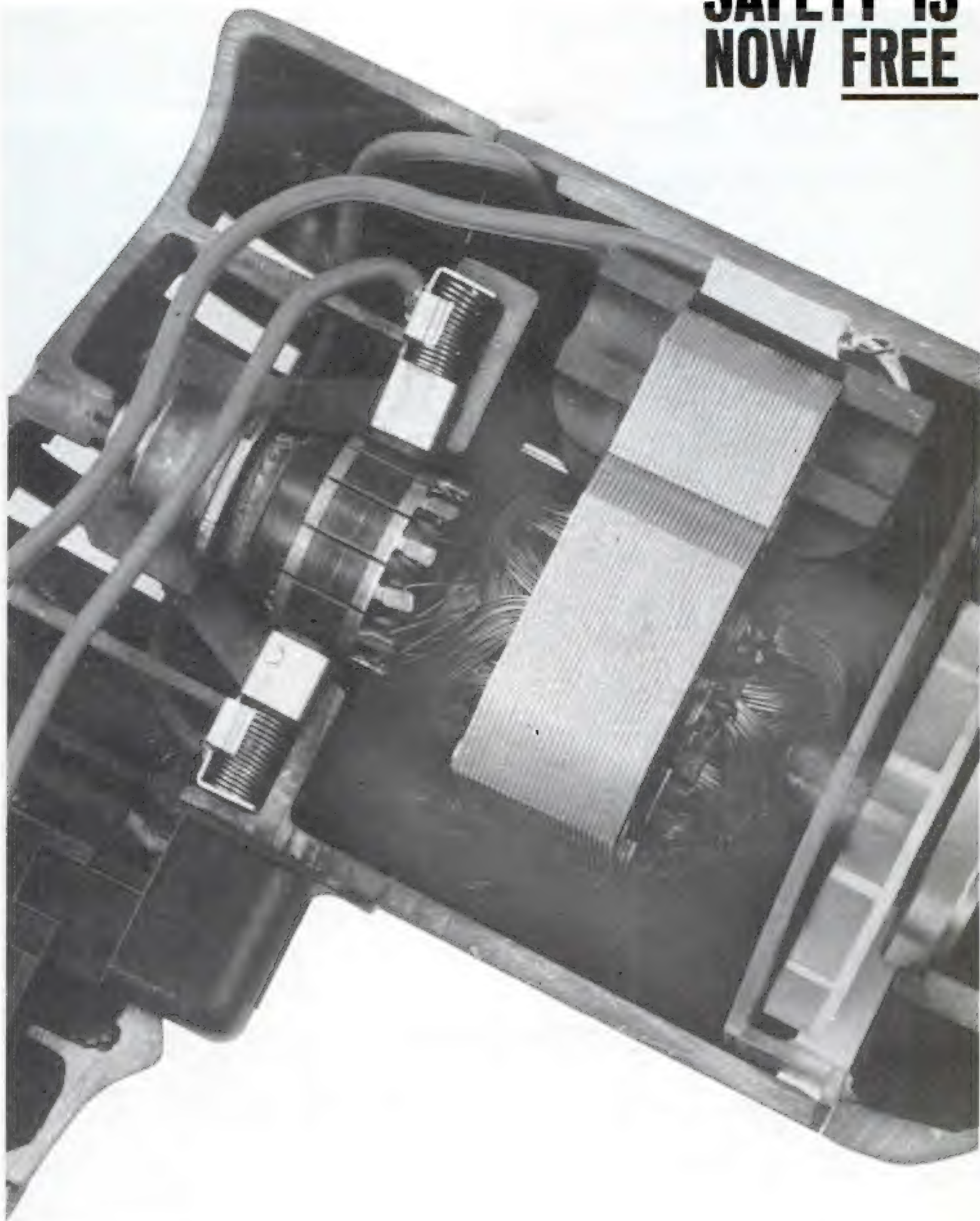
**TEDDY** Bear transistor radio, \$14.00. Johnson, Box 1581, Worcester, Mass. 01601.

**PERFECT** Stocking gift! Beautiful simulated gold ballpoint pen with certificate for unlimited free refills for life of pen. Complete satisfaction or money refunded. Send \$1.00 to Lee's Co., Box 31, Oaklyn, New Jersey 08107.

**CHEAPEST** Gifts! Free catalogues. Mandarin International, 214 Shaws Building, Hong Kong.



**SAFETY IS  
NOW FREE**



That's why when you look into power tools deep enough you'll decide on  
**MILLERS FALLS NEW SHOCK-PROOF DELUXE**



# Part by part the excitement grows in Millers Falls deluxe Shock-Proof Drills.

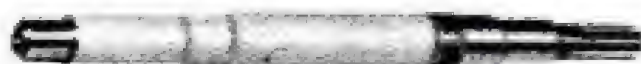
If you recall the last time you were on the receiving end of a totally unexpected electric shock, one thing is for sure. You don't look forward to another.

And you should be a good prospect for tools with the safety built in, not patched on with a third wire that makes you look far and long for a three-prong outlet or adapter. Here's how we licked this problem once and for all:



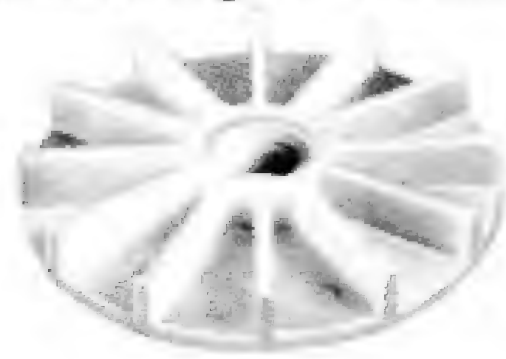
## Safety brought two dividends.

For the housing, we found a new insulating material that's not only safer, but lighter than metal and guaranteed unbreakable.



We designed a super-tough material to insulate the armature from the drive shaft so current can't leak from a burned-out motor to the chuck to you.

We even made the motor fan of high-strength insulating material to complete your double wall of insulation against electric shock.

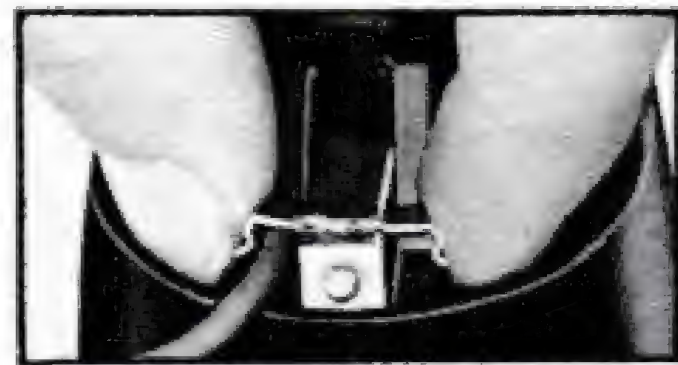


But remember — we said safety is free on these tools. A bonus you get at no extra charge.

## So forget safety.

Maybe you never touched leaking electricity. Maybe you like to take chances. Maybe you wouldn't pay a penny extra for all this safety.

Okay. Look into power...look into features...into the plain, unvarnished "feel" of a drill that can ease through a hardwood plank like it was soft sand. Millers Falls Shock-Proof is still your best buy.



## Brush changing is literally a snap.

You're never tempted to risk motor damage, by postponing a once-nasty job. Just remove two housing screws at back of handle and snap Clip-Lock brushes in or out.



Unless you're the designer's brother, you never saw this motor before.

Look how this new "wrap-around" design lowers the center line of the drill chuck. This new



straight-line thrust means faster drilling . . . with a lot less effort.



**And here's more comfort for you.**

You can grip this man-sized handful with all four fingers and a thumb. The Sure-Grip surface won't slip, even when the going gets rough. And notice the safety Lock-Button . . . recessed so you can't lock the switch accidentally, even if you're a left-hander.

**Even the plug makes your life easier.**

Plug into any 2 or 3 hole outlet. Shock-proof tools are safe to use without grounding.

Other quality features include a geared chuck and key to match, strain-relieved cord, precision-machined gears and a new, sturdy separator to keep them aligned. And two of the four drills offer a real plus:



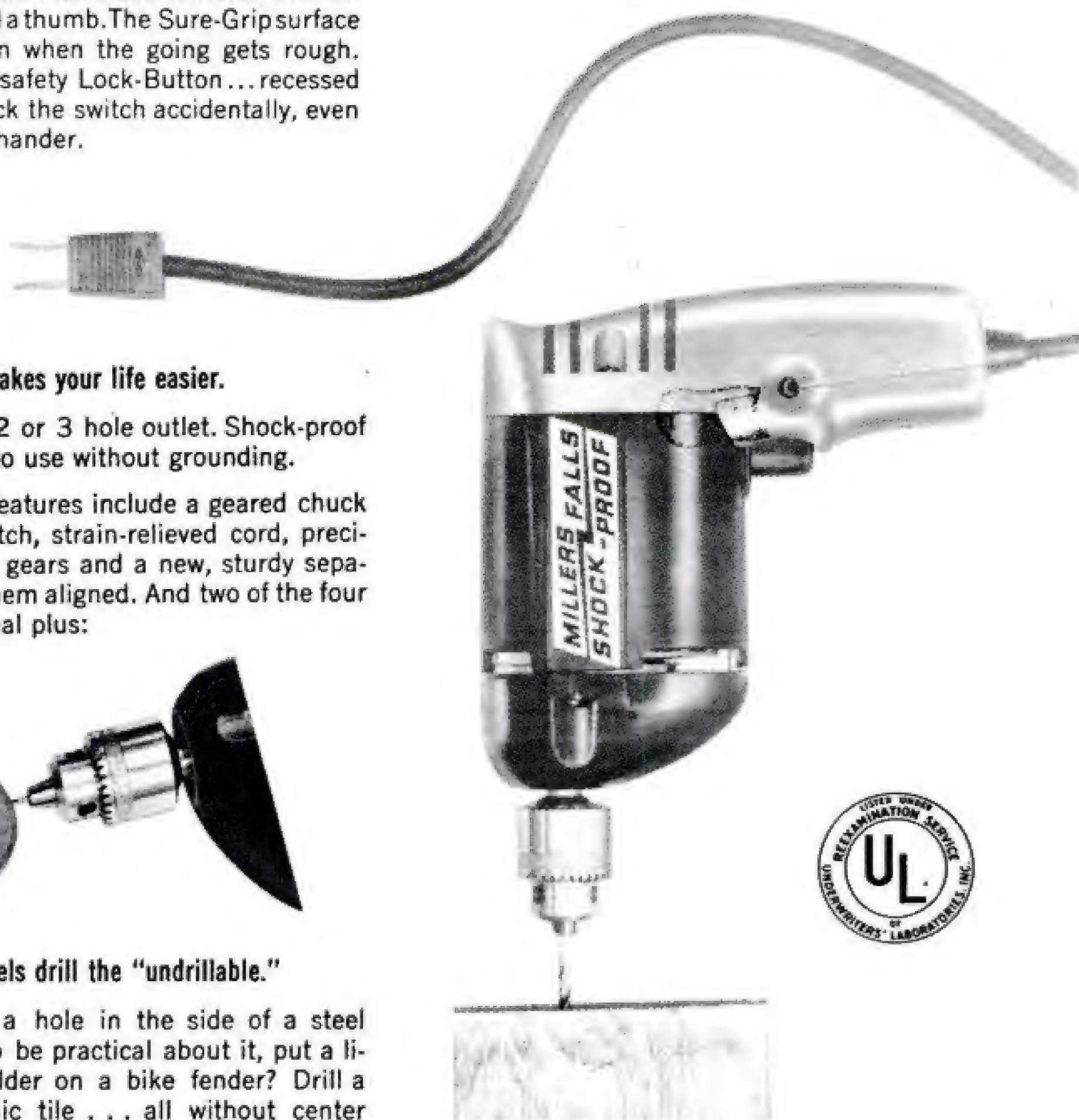
**Vari-Speed models drill the "undrillable."**

Want to drill a hole in the side of a steel washer? Or, to be practical about it, put a license-plate holder on a bike fender? Drill a hole in ceramic tile . . . all without center

punching? Or maybe you'd like to make yourself a power screwdriver, just by changing bits. You can do all these jobs and more with our Shock-Proof Vari-Speed drills.

Just squeeze the "accelerator switch" to vary drill speed from zero to full RPM's. No buttons, no gears, no attachments to slow you down. Just smooth, stepless power flow. And the right speed for any job.

Sound good? These new drills do have a lot going for them. So why not ask your Millers Falls dealer to show you the proof: *To make tools safe, you've got to make them better. We do, in Greenfield, Mass.*





**This new  
value leader  
comes in  
4 versions...**



**Shock-Proof 1/4" Deluxe Drill —  
\$14.88**



**Shock-Proof 3/8" Deluxe Drill —  
\$18.88**



**Shock-Proof Vari-Speed 1/4"  
Deluxe Drill — \$23.88**



**Shock-Proof Vari-Speed 3/8"  
Deluxe Drill — \$28.88**



**Shock-Proof 1/4" Deluxe Drill Kit  
— \$23.88**

**America's newest and safest power tools.**

Each one is  
backed by this  
Millers Falls  
Lifetime Guarantee...

**100% repair guarantee extended to the original user. Millers Falls will repair any tool that fails for any reason other than abuse or normal wear, provided the tool is returned to Millers Falls transportation prepaid.**



This Fall and Christmas season, Millers Falls retailers are offering special values on quality hand and power tools.

# **Millers Falls**

**The safest name in tools**



# What's a nice truck like you doing in a place like this?



**Here's the 1967 Chevrolet with improvements by the  
dozen and a sprightly new look.**

The way it looks, the '67 Chevy pickup should stay out of dumps. In fact, judging by those dashing lines, this one should do only nice, polite things. But the way it *works* is something else.

Because there's never been a tougher Chevy pickup than this. It's built to last longer with new body sheet metal that fights rust and a pickup box made of double-walled steel. And it gives you more safety features and famous Chevrolet truck 6-cylinder or V8 power.

So don't let that slick appearance fool you. The '67 Chevy pickup is a roughneck underneath. . . . Chevrolet Division of General Motors, Detroit, Michigan.



*A brand new breed for '67!*



# NEW FOR CAMERA BUFFS

BY LEONARD SAMUELS



1

**1 Deep-six shooters** can buy 11 underwater camera housings for Kodak Instamatics and movie cameras, with and without light units, for \$39.95 to \$67.50. Underwater Photographic Service, Box 884, Marathon, Fla.



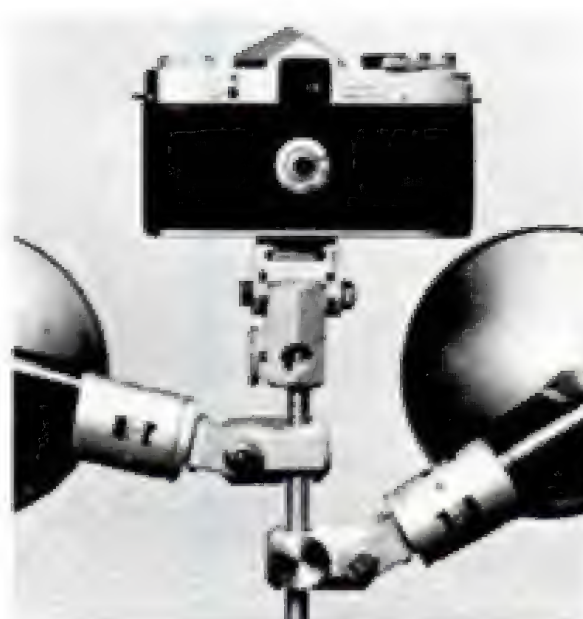
2

**2 No under-exposure is possible** with the SR-T 101 SLR. It has a contrast-light-compensating meter whose twin cells affect each other. ASA is 6-6400. Price with 58mm f/1.4 lens is \$334.50. Minolta Corp., 200 Park Ave. South, New York, N.Y.



3

**3 Twin CdS meters** automatically average light through the lens of the Yashica TL-Super. Meter switch or partly depressed shutter release stop down diaphragm for true reading. With 50mm f/1.7, \$225. Yashica, 50-17 Queens Blvd., Woodside, N.Y.



4

**4 Steady in any position** is the \$5.75 Lowel-Light Tilter. It holds flash, strobes, movie lights or cameras and permits stacking them on one light stand. Tilt tension is adjustable. Lowel-Light Photo Engineering, 421 W. 54th St., New York, N.Y.



5

**5 One lens for eight** is what you substitute with the Spiratone Proxivar close-up lens at \$15.95. Designed for any SLR, it focuses to about 3½ in. Spiratone, 135-06 Northern Blvd., Flushing, N.Y.

**6 35mm enlarger for \$29.95** has coated 50mm f/3.5 clickstop lens, hinged glassless negative carrier, geared focusing and adjustable 5x7-in. easel. Accura, Ltd., P.O. Box 47, Flushing, N. Y.



6



# What a torch!

- It burns for hours on butane gas.
- Adjusts from pinpoint to blowtorch flame.
- It's lightweight, compact, easiest to handle.
- It's non-clogging...cleans itself.

## It's the Ronson Varaflame Torch

only \$**4<sup>95</sup>**



FOR LAYING OR PICKING UP  
ASPHALT FLOOR TILES



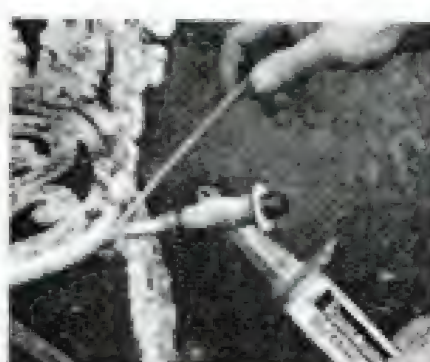
SWEATS AND THAWS PIPES



REMOVES PAINT



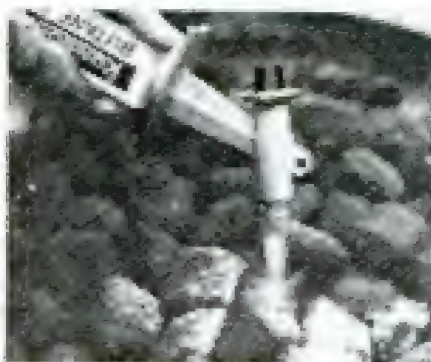
SORTENS PUTTY



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This great new Ronson Torch is perfect for hundreds of household and hobby uses. It uses the same fuel used to fill famous Ronson Varaflame® lighters... Ronson Multi-Fills, available everywhere! Comes complete with large size Ronson Multi-Fill® fuel injector, and big instruction and idea book.



# Why "Power Piston" shooters seem to have all the luck.



It's not luck.  
It's "Power Piston". The Remington patented (U.S. Pat. No. 3,217,648) one-piece wad column and shot protector.

"Power Piston" puts up to 10% more knockdown power in the pattern of every Remington shotgun shell.

Some Remington shooters consider "Power Piston" a sort of secret weapon. But there's no secret to why "Power Piston" does what it does: The rounder the shot's kept, the more effective the pattern. Round shot travels straighter, travels farther, hits harder.

"Power Piston" helps keep the shot round...all the way to the target.

It's that simple. "Power Piston" helps prevent pellets from flattening against the inside of the barrel.

Prevents them from deforming against one another. Pellets start round, stay round. So more of them fly true.

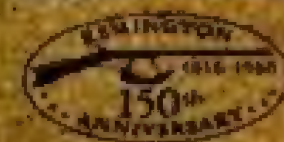


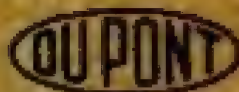
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**Remington** 



THE

# FASTEST TRAIN

**IN AMERICA**

Hanging cars like pendulums, powering locomotives with jet turbines, the aircraft industry is bringing supersonic ideas to railroading, and the result is speed

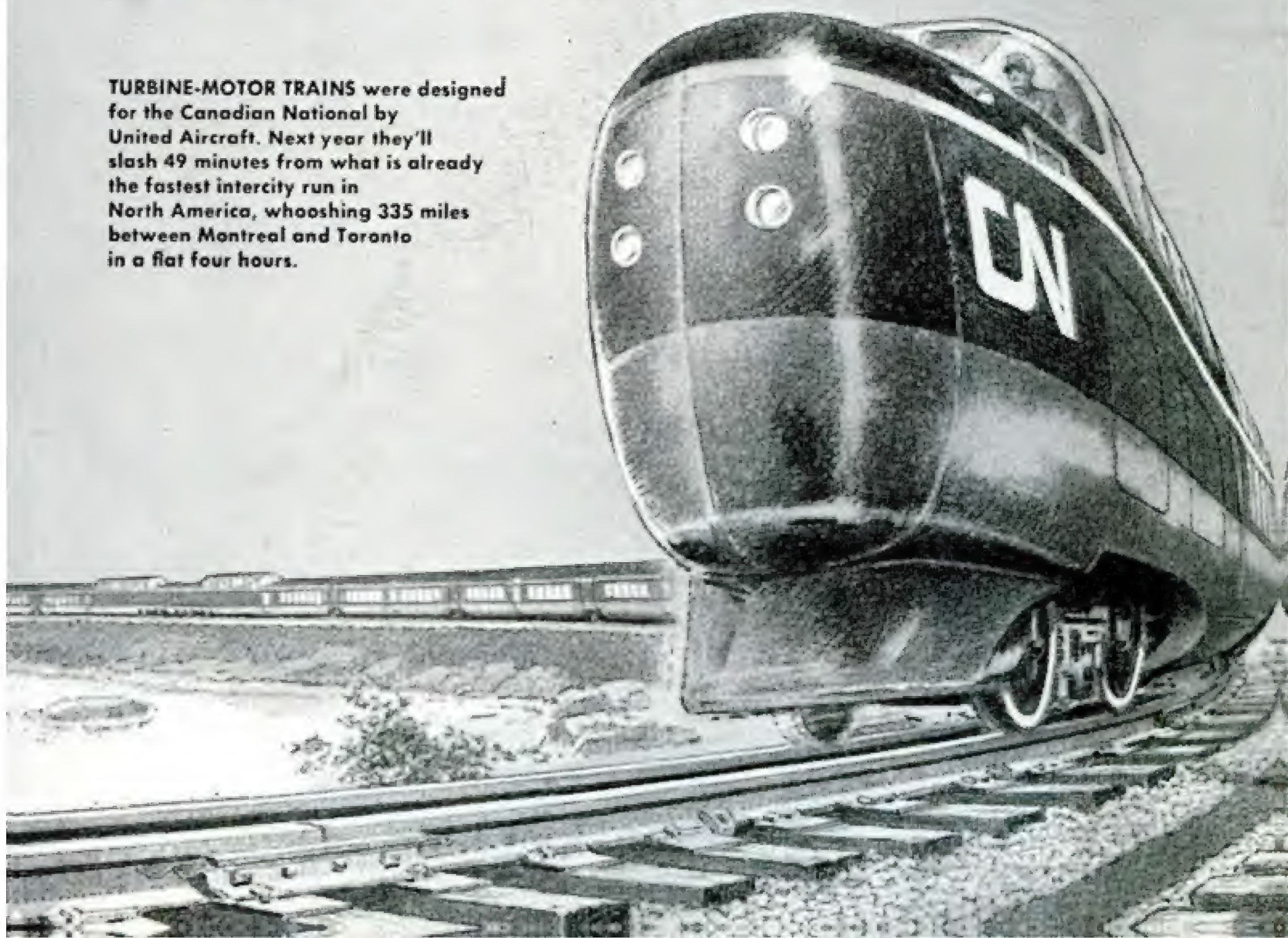
By HENRY B. COMSTOCK

Drawings by the author

**S**TREAKING OVER PRAIRIE RAILS south of Chicago, the first of a new breed of passenger trains will be put through an ordeal by fire next month: Visible fire, squirting from brake shoes during torturous deceleration tests, and invisible fire, triggering tornadoes in six gas turbine engines as they torque the three-car flyer from one milepost to the next in  $22\frac{1}{2}$  seconds. That's 160 miles an hour.

The railbird's designer, power-plant producer and owner is the United Aircraft Corp. The coach builder is Pullman-Standard. And the customer who will lease the train and another like it for a two-year transportation study is

**TURBINE-MOTOR TRAINS** were designed for the Canadian National by United Aircraft. Next year they'll slash 49 minutes from what is already the fastest intercity run in North America, whooshing 335 miles between Montreal and Toronto in a flat four hours.





the U.S. Department of Commerce. North of the border, five seven-car speedsters of the same basic type will be leased to the Canadian National Railways. There, the Montreal Locomotive Works is converting U.A.'s blueprints into aluminum-bright reality.

This leads to an obvious question: Why is a leading aircraft manufacturer going all-out to promote competitive earth-bound vehicles?

### Race to beat flying time

The airlines know the answer. One of these days—and soon—somebody's high-speed trains are bound to top the best flying time they can offer between cities 300 or less miles apart. So they are philosophically adjusting their purchases, and wishing United Aircraft well.

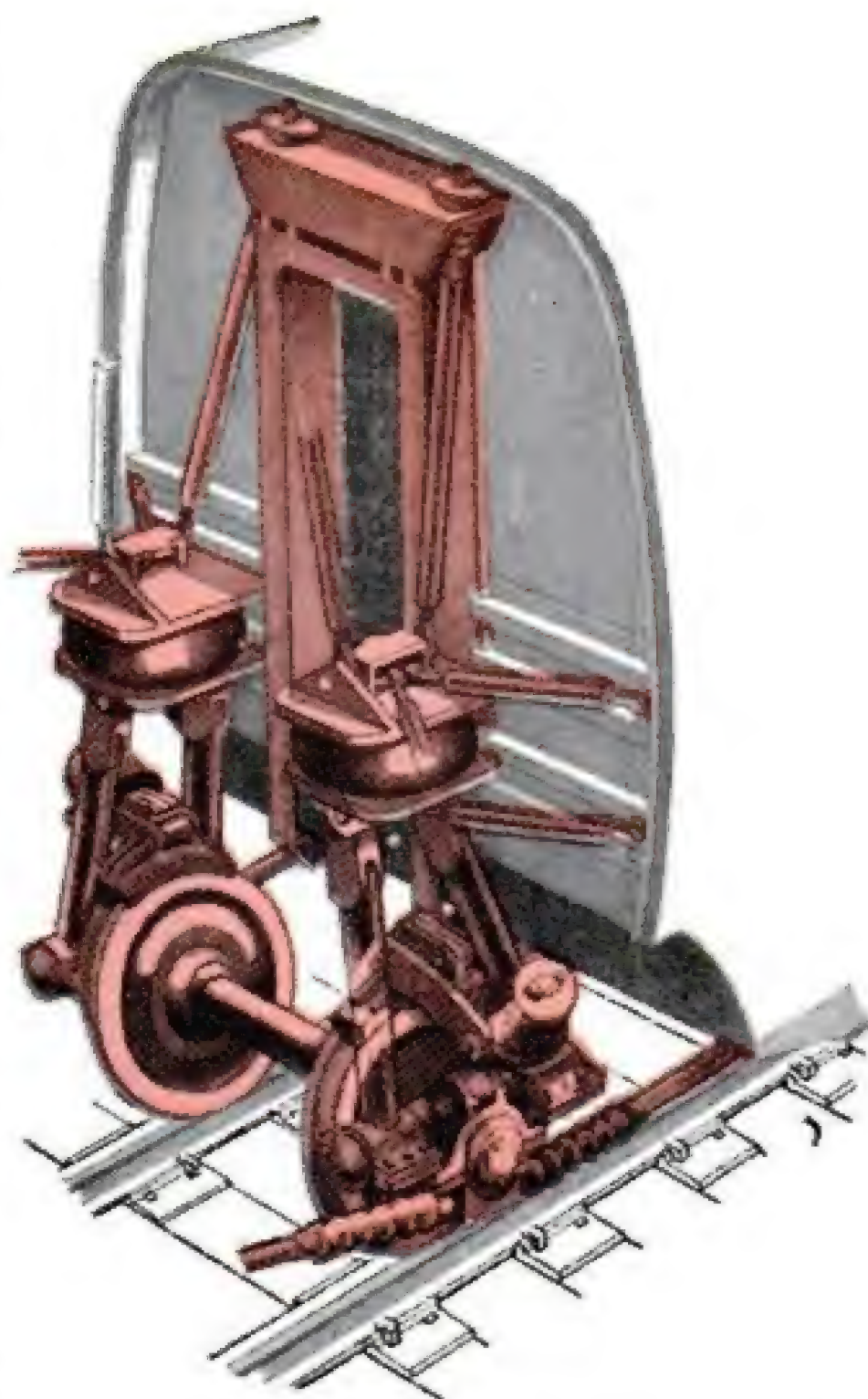
U.A., in turn, is a jump ahead in the current scramble to get the right trains on the rails. More than three years ago its corporate systems center launched a two-pronged railroad survey. One purpose was to pin down the passenger potential on promising intercity routes. Not in round figures, but on an hour-to-hour density basis. This would show how many trains of what seating capacities could most efficiently handle traffic at airline speeds.

The other part of the study dealt with the generally unfortunate anatomy of existing roadways: long, stiff grades, dips and hillocks, dogleg curves, slow-order bridges, close-spaced signals.

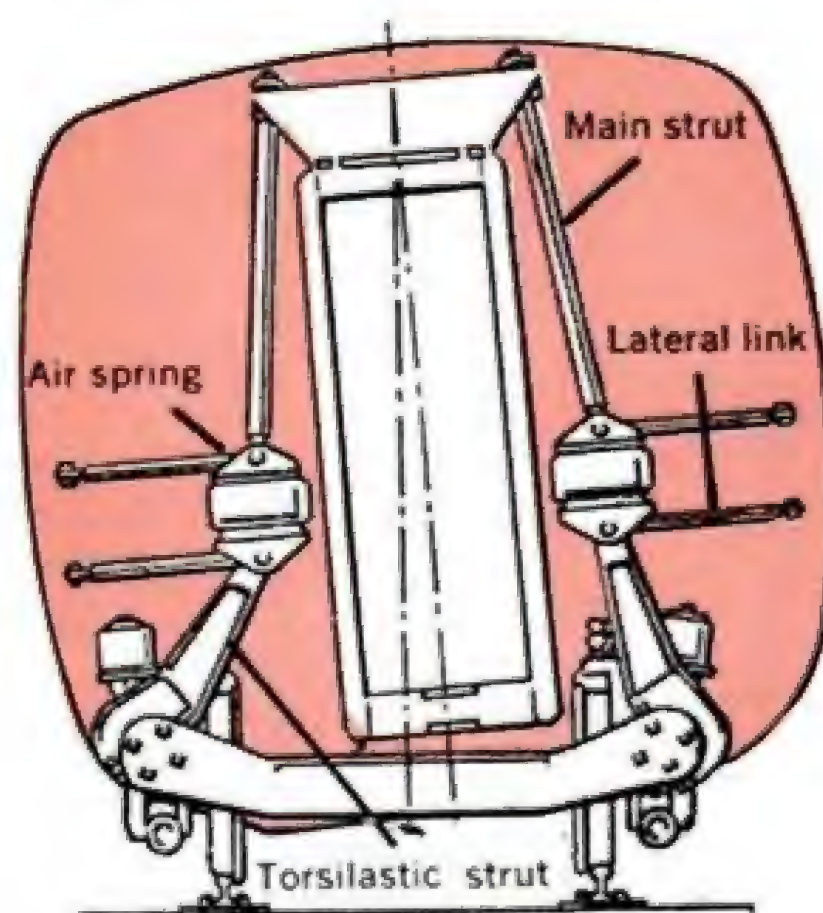
All this data was fed into computers at U.A.'s research laboratories. Winking and chattering, the clever machines came up with the horsepower and tracking characteristics needed for each run. Also, the demands for what aircraft designers solemnly call "creature comfort." That's washrooms, buffet counters, observation sections, climatizing—you name it.

It didn't take a cabinetful of diodes to point out that a compromise, here and there, wasn't going to produce a do-it-all train. But a properly suspended and sprung basic structure would fill the bill if it was customized with car-interior modules and building-block mechanical equipment.

The starting point was the powerplant. United Aircraft of Canada, Ltd. was—and still is—turning out a very efficient free-turbine engine for helicopters and small



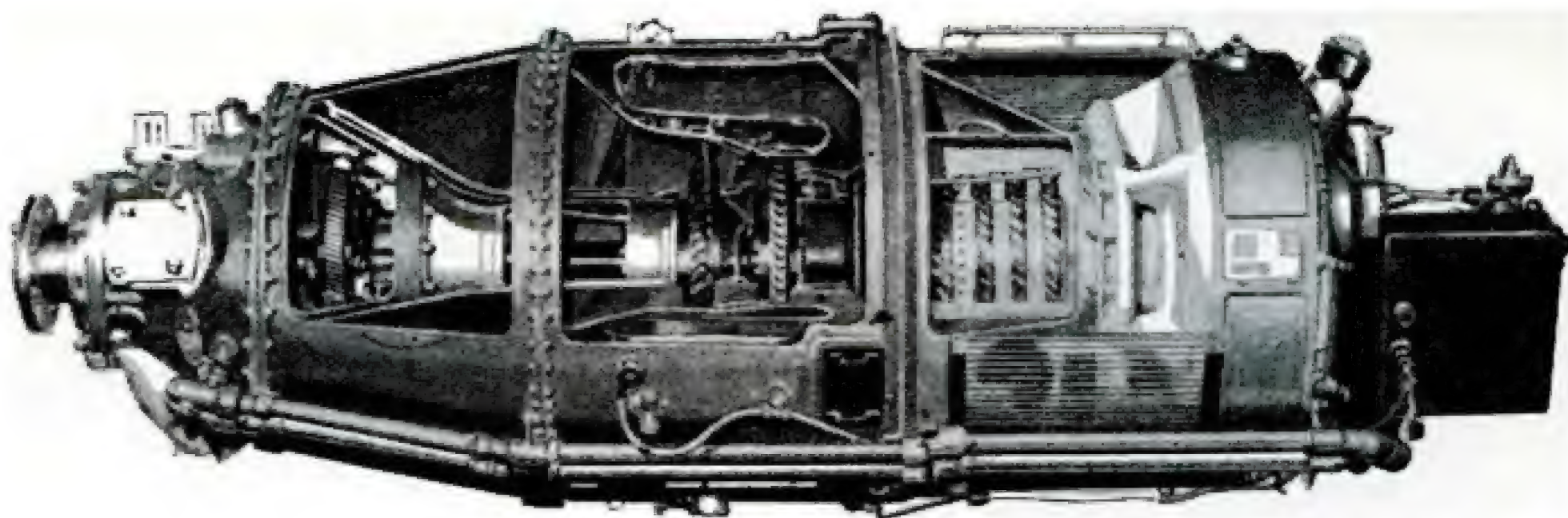
**SINGLE-AXLE SUSPENSION SYSTEM** is shared by adjacent car ends. Each three-ton assembly takes the place of two conventional eight-ton trucks



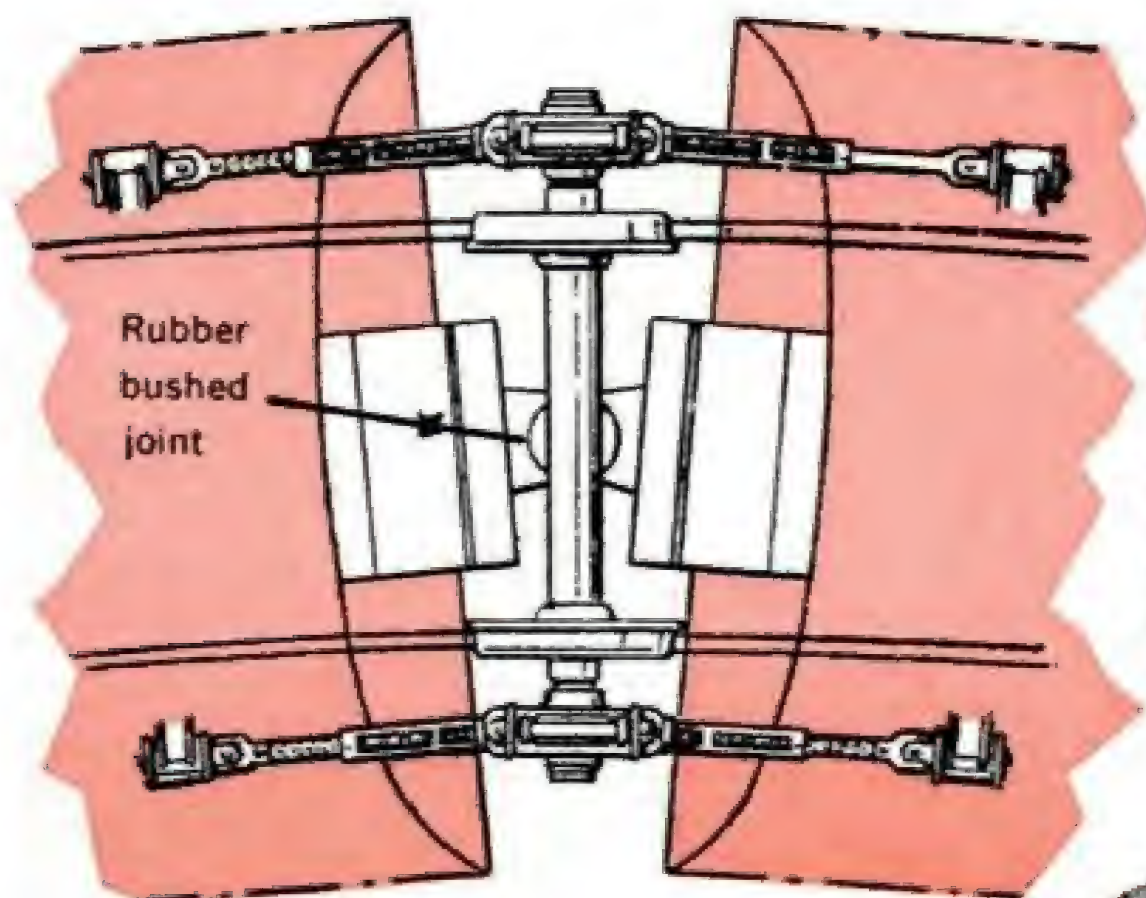
**SUPPORTED AT THE TOP**, "pendulum car" bodies respond to centrifugal force by banking inward on curves. Air springs produce a soft, stable ride







**EIGHT OUNCES PER IRON HORSE**—that's weight-to-power ratio of 250-pound engines (modified Pratt & Whitney ST-6s), each supplying 500-hp to cars of Turbine Motor Train



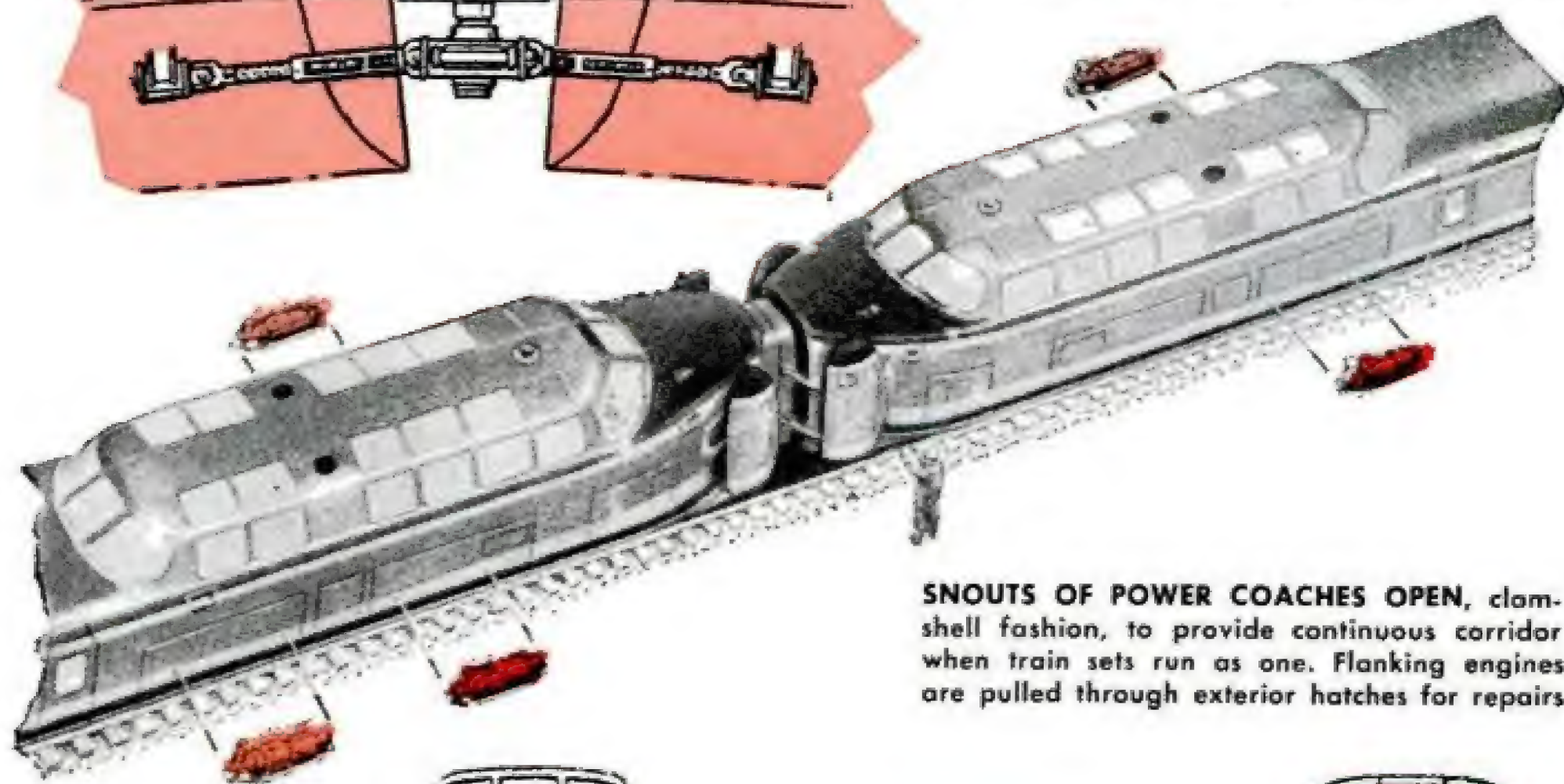
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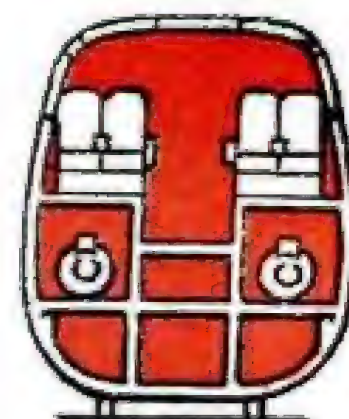
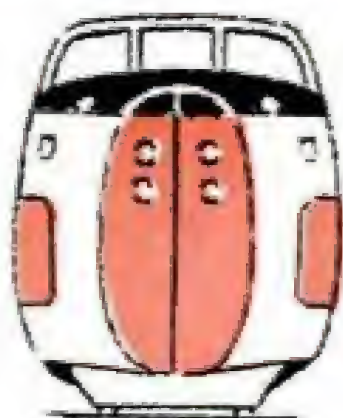
Air-brake unit

**RUBBER-BUSHED JOINTS** (left) connecting articulated cars eliminate slack and noise. Overhead braking setup (above) simplifies wheel replacement, stops 120-mph train in 3500 feet

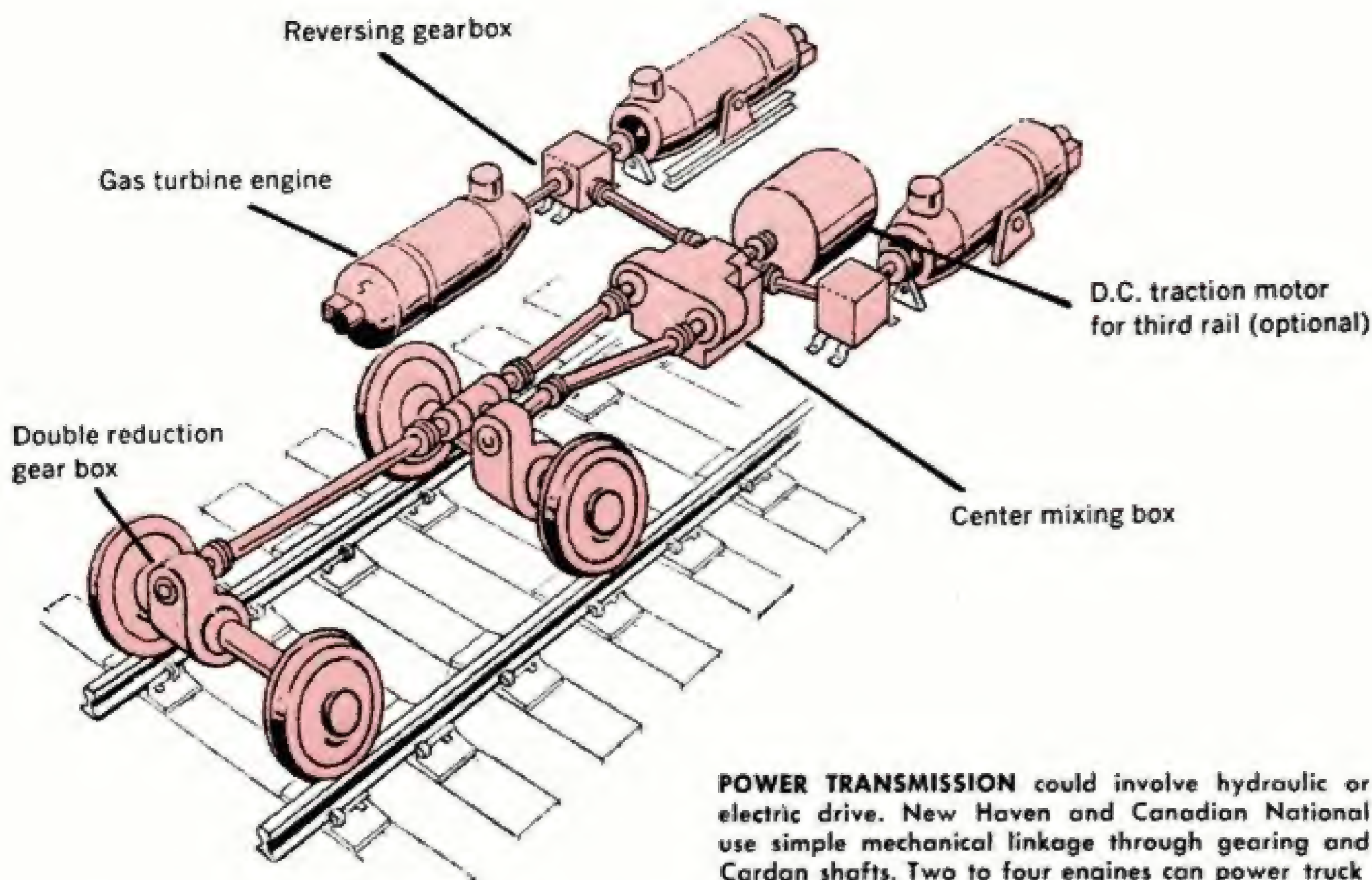


**SNOUTS OF POWER COACHES OPEN**, clam-shell fashion, to provide continuous corridor when train sets run as one. Flanking engines are pulled through exterior hatches for repairs

**PROFILE** and cross-sections show two-headed train. Cars are three-fourths length of standard coaches, domes a bit lower than conventional roofs. Structural load is 5 lbs. per seat







**POWER TRANSMISSION** could involve hydraulic or electric drive. New Haven and Canadian National use simple mechanical linkage through gearing and Cardan shafts. Two to four engines can power truck

military and civilian planes. Only 19 inches in diameter and 5 feet long, this Pratt & Whitney ST-6 delivers 500 horses. Why not buckle a bundle of them to the driving axles of the prospective train? Six for traction, plus one to whip up wattage for train controls and lighting, heating and airconditioning, would take one-tenth the space of a 3000-hp diesel. The latter, with its cooling and electric-conversion system, inevitably called for a separate locomotive. But the ST-6 could be comfortably tucked beneath revenue seats.

There were other pleasing possibilities. For while an electric or hydraulic drive was mechanically feasible, a free-turbine engine would actually offer its own transmission setup. What amounts to a fluid-air clutch connects the separately-shafted gas-compressing and power-output sections. Since the former normally operates at a governor-controlled top speed, full torque could be poured onto the rails when it was most needed—at starting. Then as the train got under way, torque would be traded for speed. A control lever would overrule the governor during decelerations. The only other requirements were gearboxes for reversing and to reduce the turbine's 6000 rpm to 3000 at the axles.

Next, the ST-6s could be fired up and

brought to full power within a minute. Under similar conditions, a diesel had to be idled during layovers. The fuel the turbines saved there, combined with their contribution to reduced train weight, would far more than offset their relatively greedy appetites.

Finally, at shopping time, the 250-pound midgets could be pulled and replaced in an hour.

### **Coaches redesigned**

Once they had settled for the ST-6s, U.A. engineers found that they were being nudged into a distinctive coach arrangement as much by the modest demands of the powerplant as their own preferences. They wanted a two-headed Turbine Motor Train, or "TMT" as they were beginning to call it, to eliminate turnarounds at terminals. For this they needed a driving truck at either end. The engines must be close to the axles and the passenger areas above them would have to be raised two feet higher than the desired roof level.

Then, making a virtue of it, the engineers roughed out sketches for observation domes there, with control cabs at the forward ends. That would offer maximum visibility for the crew.

Behind the domes, the power cars

*(Please turn to page 230)*



# SAFETY MYTHS THAT MESS UP YOUR DRIVING

Are speed and tailgating the major causes of accidents? Do traffic signals always reduce collisions at intersections? No, says a new Purdue University study, which also demolishes several other widely accepted 'facts'

By JOHN F. PEARSON

**Y**OU DON'T HAVE TO BE A WIZARD to predict one story that will make the front page of your local paper on Jan. 2, 1967. The headline: HOLIDAY HIGHWAY SLAUGHTER HITS 1100.

Those may not be the exact words and the figure may be off—but probably not by much. Last year, the Christmas and New Year's weekends produced 1282 traffic fatalities; the year before that, 1070. And then there are those other holidays, like Memorial Day and July Fourth, when newspapers, radio and TV keep a death watch.

The grisly reports shake us up, but do they really



HIGHWAY PLANNED FOR SAFETY might have given one of these drivers a chance to remedy mistake and avoid disastrous accident



scare most of us? And do they frighten us into becoming better and more thoughtful drivers?

At least one traffic expert—Prof. Harold L. Michael of Purdue University—doesn't think so. He is associate director of the Joint Highway Research Project, a group sponsored by the university and the Indiana State Highway Commission to study traffic engineering and highway planning. Sixteen years of research has convinced Prof. Michael that many widely accepted notions actually foul up attempts to improve highway safety. These notions, or myths, he maintains, keep us from seeing where the real problems of traffic safety lie.

Here are some of the most prevalent of these ideas:

**Myth: Scare warnings help to promote safety.**

Though based on solid fact, observes Prof. Michael, the warnings scare nobody. "Though we're told that traffic accidents kill more people than almost any single disease and that one member of almost every family will be injured in an auto accident some day, an accident seems like a rarity to most of us," he says. "The average motorist doesn't really believe driving is dangerous. If he did, he would drive differently, drive less, or use his seat belt and other protective devices more frequently.

"Under such conditions, scare techniques are not apt to be fruitful."

**Myth: Speed is the prime cause of accidents.**

Reduce speed, this myth tells us, and the accident problem diminishes. Though

speed is a factor, it isn't speed above any given mph, according to the Purdue professor. "Recent research on arterial highways showed the safest speed to be about 60 mph," he explains, "and that 20 mph less than 60 was just as hazardous as 20 mph more."

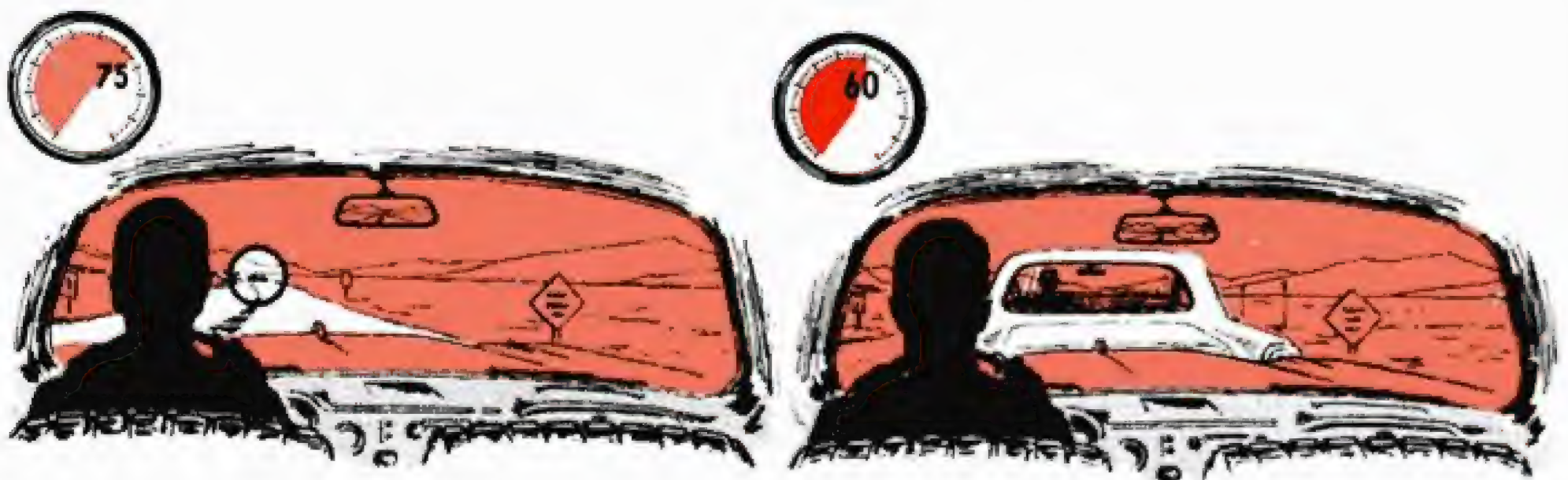
The safest speed on any highway, Prof. Michael contends, is the speed at which most drivers are moving. Studies show that drivers as a group can be relied upon to determine a safe average speed. That means, Prof. Michael says, that speed limits should be imposed on a stretch of road only after an engineering study, including actual speeds used by drivers. Limits should never be based simply on "roadside opinion."

**Myth: Drivers respond better to regulation than advice.**

Purdue researchers find the opposite to be true. Drivers pay attention to speed advisory signs commonly posted at sharp curves because those signs usually give realistic advice as to the speed at which the curve can safely be taken. On the other hand, studies show that speed-limit regulations are often disregarded because they aren't realistic.

To go a step further, Prof. Michael thinks it would be worthwhile to consider a general use of speed advisory signs as opposed to speed limit signs. In effect, regulatory signs tell the driver that it's unsafe (as well as illegal) to go over a certain speed. But the driver knows better; he knows that, say, 10 mph above the limit is perfectly safe. A safe speed depends on road conditions, weather, visibility, traffic density.

There is no location, Prof. Michael



**WHICH IS MORE DANGEROUS?** Driver (left) is moving up fast to overtake car in the distance; second motorist is tailgating. One of these practices is less risky because driver's attention is sharply focused



points out, where one speed is always the safe maximum speed.

**Myth: Rear-end collisions are almost always caused by tailgating.**

The Purdue investigation shows that many of these accidents, which have increased in recent years, occur when drivers move up fast to close a big gap between them and the car ahead. Few people, Prof. Michael points out, are good at judging rapidly diminishing distance. Before they know it, they're crawling up the back of the guy ahead.

And there's another angle to consider. The attention of the tailgater is sharply focused, says the professor. He has his eye glued to the car ahead and is less likely to be surprised by a sudden deceleration or stop than is the driver who's coming up fast from far behind and doesn't have his attention so sharply fixed.

**Myth: Traffic signals always reduce accidents at intersections.**

The opposite is closer to the truth, says Prof. Michael. Facts prove that lights almost *never* decrease the number of accidents.

The Purdue research group recently studied three intersections in Indiana where lights had just been installed—and found that in each case the number of accidents increased, especially the rear-end variety. Bodily injuries increased, too. The only reduction was in right-angle collisions.

Here are figures on one of the intersections: Right-angle accidents were reduced by 30 percent, but rear-end smacks increased 3.6 times. Overall, there were 1.3 times as many accidents with 2.2 times as many injuries.

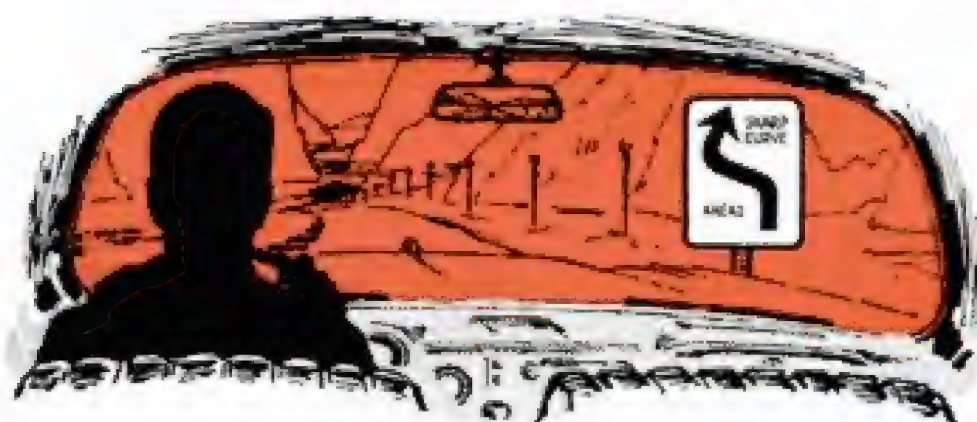
Such results, they point out at Purdue, are not at all unusual, especially when installation of a light isn't dictated by traffic volume or a high incidence of right-angle accidents. Of course, signals have a function, says Prof. Michael. But they should be installed only as a result of an engineering study, not in response to popular demand arising from an accident.

**Myth: Most accidents are caused by hot rodders, drunks, morons, speed demons.**

Most people accept this myth, explains Prof. Michael, because they would not apply any of those labels to themselves. At the same time, he points out, statistics show that about 10 percent of all motorists are involved in accidents each year. Put two and two together, and you've established that the 10-percent slice is made up of speed demons and screwballs. Get them off the road, the thinking goes, and the accident problem would be fairly well licked.

But the facts are, says Prof. Michael, that "nice people—doctors, teachers, farmers, lawyers, housewives, public officials—have accidents and, by and large, if we took off the road the 10 percent of drivers who have accidents this year, we'd have about as many accidents next year—from a different 10 percent of nice people."

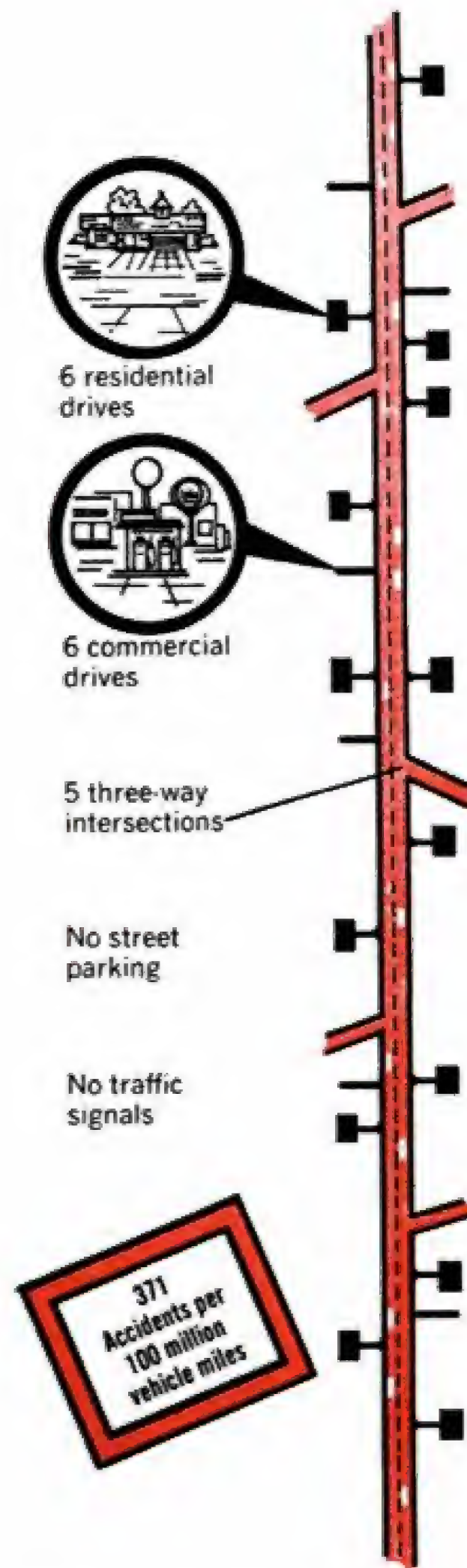
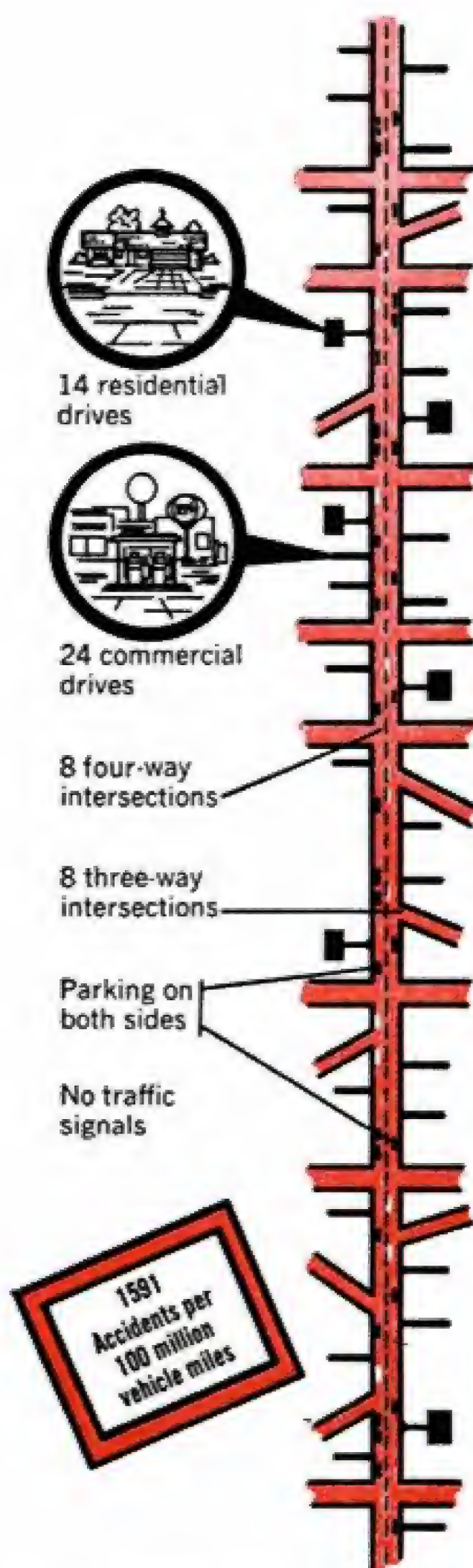
In addition to those described, there are other practices and beliefs, Prof. Michael notes, that hinder our chances of improving highway safety. Perhaps the most important is the concept that we can make any driver a perfect driver, a perfect human being. "This notion has led to a system—embracing vehicle, driver and road—safe only for the error-free driver. And there is no such thing. Driving in this system is too complex for anyone to handle



**WHICH IS THE MORE EFFECTIVE SIGN?** Don't jump to conclusions, for studies reveal surprising things about average driver's response to purely advisory sign (left) as opposed to usual speed-limit type

NOVEMBER 1966





**WHAT MAKES FOR ACCIDENTS?** Road (left) carrying 6300 cars a day has far more collisions than other section with daily volume of 6600. The first road permits parking, has far more intersections and drives

well *all* the time. The results are accidents.

"Improvement in the safety of the system can result if we design it for the driver who is not perfect, if we construct it for the driver who might make an occasional mistake. This can be done by designing a system that reduces conflicts between vehicles and permits common errors to be made without disastrous consequences.

"Modern freeways and interstate roads are steps in the right direction. On them, conflicts are reduced by separation of directions of flow via medians, by separation of cross traffic by interchanges, of entrance and exit movements by limited ac-

cess, of conflicts in the same direction by multilanes and uniform speed. Errors are permitted by wide medians, paved shoulders, wide rights-of-way, elimination of roadside obstacles."

All roads can not, of course, be turned into access-controlled multilane highways. But, Prof. Michael believes, good design principles can be used to improve them. On any highway, he says, it's possible to accomplish these things:

- Reduce the number of access and exit points to minimize conflict between through traffic and slow leaving and entering traffic.



- Construct acceleration and deceleration lanes at access and exit points, or extra left turn or right turn lanes—again to reduce conflict.

- Eliminate roadside obstructions, such as trees, posts, abutments and signs.

- Obtain additional rights-of-way for improved shoulders so that the imperfect driver has a chance to escape from the product of his errors.

- Illuminate those areas where the driv-

er can't see sufficiently well at night.

Though Prof. Michael's stress is on improving the highway, he doesn't say that we should forget about other safety approaches. He believes there is value in programs designed to upgrade driver skills. And he thinks that we should continue to improve safety features of cars. "But unfortunately," he observes, "many auto safety devices only become useful *after the fact.*" ★★★



**WHY SIGNAL SHOULD NOT BE INSTALLED** unless called for by engineering study. With two-way stops, this intersection in Indiana was scene of nine accidents during two-year period. With light installed, collisions more than doubled, report Purdue researchers, and cases of bodily injury increased from one to five



# Drivin' with Dan

How good are shoulder-chest belts? Is there a limit to how fast cars can go at Indy? If Mercedes entered racing again, would it win everything in sight? Dan Gurney answers these and other provocative questions



**DAN GURNEY** (right) welcomes British star Jackie Stewart to Indianapolis before start of 1966 500. Stewart went on to lead race in closing stages, had it "won" until his engine failed on the 190th lap

**Q.** I've heard it said that Indianapolis is a driver's track and Daytona an equipment track. Do you agree?—Bill O'Toole, Lexington, Ky.

**A.** No, but top-end power is more important at Daytona.

**Q.** My buddy says that if Mercedes ever decides to get back into racing, they could win all the marbles the first time out. Do you agree?—Dave Flowers, Beverly Hills, Calif.

**A.** It is possible, of course, but I cannot see it happening. Much of their "invincibility" was due to an excellent public relations department, Mr. Fangio and Mr. Moss. I would love to see them try their hand at winning marbles again. They were a great credit to racing and a great stimulant to engineering.

**Q.** Is there any way I can practice to speed up my reaction times to various and typical driving situations I might meet?—R. M. Fitzpatrick, Toledo, Ohio.

**A.** I doubt it; however, you can accomplish much the same thing by trying to think ahead all the time. In other words, if you can anticipate and react it is far safer and requires much more normal reaction time than having to panic and react in almost the same instant. Good driving should not include panic stops, nor the necessity for superfast reaction times.

**Q.** How much faster can they go at Indy?—T. G. Tuttle, Akron, Ohio.

**A.** They always seem to be able to go a little faster. Reduction in the legal engine sizes would, of course, tend to curb speed. With the current push toward "one world of racing," displacement apparently soon will be limited to the Formula 1 restrictions (currently 3 liters, or about 183 cubic inches). Frequently overlooked, however, is the difference that handling and suspension innovations can make in lap speeds on a given race course.

**Q.** What makes the Wood Brothers pit crew so good?—Tom Walker, Lafayette, Ind.

**A.** They are thorough. They are a true team with almost military discipline although it is cloaked in their easy-going style. They are careful to leave no stone unturned—a good formula for success in any endeavor. They are also great competitors who love the sport and some of the nicest guys I've ever met.

**Q.** A few years ago all cars had manual gear-shifts. Then automatic transmissions came along as an extra-cost option. Now people are paying extra for 4-on-the-floor. Does this make sense?—G. D. Roberts, Dallas.



**A.** From the standpoint of production costs, and since automatics are now more popular, I suppose that it does.

**Q.** I've heard shoulder-chest belts put down as neck-slashers in an accident. What do you think of them for the average car and driver?—Ernest Harper, St. Louis.

**A.** No matter what you wear, if you have a severe enough accident you'll get hurt. I believe that all of the NASCAR drivers now wear shoulder-chest belts, and they seem to walk away from most of their accidents.

**Q.** Recently, while going down a pretty steep hill in an old clunker, I lost the brakes. Isn't there something I could have done besides steer and pray?—Alvin Black, Deer Lodge, Mont.

**A.** The emergency brake might still work. You might get into low gear or at least second or low range with an automatic.

**Q.** In a four-wheel drift while cornering, at what point in the curve—if at any point—do I stick my foot in it . . . and how hard?—Steve Lancaster, St. Paul.

**A.** It depends on many things—what car, tires, engine, the corner, the surface, the weather, etc. If you must try it, begin on a dirt road where you can do it all at lower speeds. Wear a safety belt and crash helmet. Check your car and tires over carefully. Make some provision for medical assistance if necessary. Make sure that you won't involve other traffic, people, or property. Also, avoid the police.

**Q.** Ford is supposed to be making a special Fairlane for dragsters. What's it called, what makes it so special, how much does it cost, and how can I convince my wife we ought to get one? And should we?—T. J. Phelps, San Diego.

**A.** I suggest you write a letter to Special Vehicles Dept., Ford Div., Ford Motor Co., Dearborn, Mich. And maybe one to Dear Abby, too.

**Q.** Dan, please straighten me out on this "right-of-way" business. It seems to me confusion about this "rule" results in a lot of accidents, particularly in that I understand different states have different ideas about what is and is not the "right-of-way."—Jack Fisk, Quincy, Mass.

**A.** I don't think it is very wise to rely on the right-of-way. Make sure you are aware of

the local laws, of course. Local police will certainly be happy to explain them to you. The best policy is to make sure the other fellow cannot hit you even if you do have the right-of-way.

**Q.** What optional equipment should I get on a Mustang for high performance and fast highway driving? I don't intend to race or rally.—Bill Gibbons, Albuquerque, N.M.

**A.** My idea of a well-equipped Mustang would be the GT version with handling kit, airconditioning, power steering, power brakes, and low-profile wide tires. Wheels and tires must be truly round and very well balanced.

**Q.** Do you prefer a grid start or a Le Mans start?—Eddie Brown, Queens, N.Y.

**A.** It doesn't really matter to me. What does matter is where I'm starting. The safest place to be in any start is in front.

**Q.** Did Fangio ever compete at Indy? If not, why not and how come he was rated World Champion?—M. A. Hudson, Greenwich, Conn.

**A.** Fangio never actually competed in a race in Indy. He did test a car there. I was not present, but I did discuss his performance during these tests with Troy Ruttman, former Indy winner, who was there as an observer. I was interested because Fangio was my idol, and I was happy to hear Troy say that Fangio did a fine job with a car that was incorrectly set up. It would have been rather easy to set it up correctly in about 20 minutes, but the language barrier and other political problems made this too difficult. Fangio was a true champion if there ever was one. Indy is a tough track but no tougher than many others. Fangio would have done very well there in a competitive car.

**Q.** Given equal equipment and the same luck, who would you pick to win a 500-mile stock-car race, Richard Petty or Fred Lorenzen?—Carl White, Erie, Pa.

**A.** Lorenzen.

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If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 20).

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# Did flying saucers



*"It was rising slowly from behind two tall pines: a brilliant, roundish object, without a sound. It came toward them like a fluttering leaf. The entire area was bathed in red light."*



# cause the blackout?

Just a year ago the whole Northeast was plunged into darkness. For weeks beforehand, strange craft were reported over power lines in New Hampshire. Were they for real? Were they connected with the mysterious breakdown?

By JOHN G. FULLER

Illustration by Gil Evans

Author of the Best Seller: "Incident at Exeter"

**T**HE BLACKOUT caused by the failure of the Northeast Power Grid on Nov. 9, 1965, created one of the biggest mysteries in modern history. Thirty-six million people were suddenly plunged into inexplicable darkness.

Nearly 800,000 persons were trapped in elevator shafts, subway cars or commuter trains. Pilots circled vainly at darkened airports.

By Nov. 11, the *New York Times* was reporting that a stunned Northeast was struggling back toward normal, but that the cause of the blackout was still unknown. Authorities admitted there was no assurance it could not occur again.

There was a curious lack of physical damage. Only a few generators were out of action. The utilities were able to restore service with the same equipment.

If there had been a fire, a short circuit, a toppling tower, the cause would have

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been quickly detected. Early in the blackout, a line break near Niagara Falls was blamed. A fast check ruled that out.

At 10 p.m., it was announced that the difficulty lay at a remote-controlled substation at Clay, N.Y., 10 miles north of Syracuse. The high-tension lines over Clay are part of the "superhighway" of power distribution, running into Niagara Falls, east to Utica and south to New York City.

Repairmen who drove to Clay found the substation in apparently perfect order.

### **Huge red ball**

Something else happened outside Syracuse which was noted briefly in the press, then dropped. Weldon Ross, a private pilot, was approaching Hancock Field at Syracuse. It was at almost the exact moment of the blackout. As he looked below, just over the power lines near the Clay substation, a huge red ball appeared. It was about 100 feet in diameter. Robert C. Walsh, deputy commissioner for the Federal Aviation Agency in Syracuse, reported he saw the same phenomenon.

Photographer Arthur Rickerby took a dramatic picture of the New York skyline just after the blackout. In the western sky, a brilliant, silvery object appears that has not in any satisfactory way been explained. It appeared in the November 19 issue of *Time*.

The Great Blackout has still not been adequately explained. Ostensibly, backup Relay No. Q-29 at the Sir Adam Beck generating station, Queenston, Ont., was pinpointed as the source. But investigation showed nothing in the relay was broken. It went back into operation normally when power was restored. The line it was protecting was undamaged.

As late as Jan. 4, 1966, the *New York Times* raised questions regarding prevention of future blackouts. It said: "These questions more or less are related to the cause, *still not fully understood*, of last November's blackout." The italics are ours.

Although I live just out of New York City, I missed the blackout. I happened to be in Exeter, N.H., a quiet New England town of 6500, a dozen miles southwest of Portsmouth. Although areas on all sides were blacked out, Exeter escaped. I couldn't believe the news that came over the radio.

I had been in Exeter off and on for

three weeks investigating on my own a fantastic series of UFO sightings reported in the region.

I first heard about them when at 2:24 a.m. on Sept. 3, 1965, Norman Muscarello, three weeks away from joining the Navy, had plunged into the Exeter police station in near shock. He had been hitchhiking on Route 150. The traffic was sparse, and he was forced to walk. Near an open field between two houses, the Thing, as he called it, came out of the sky toward him. It was 80 to 90 feet in diameter, with brilliant, pulsating red lights around an apparent rim. It made no noise. When it seemed as if it was going to hit him, he dove down on the shoulder of the road. Then the object appeared to hover directly over one of the houses. Finally, it backed off.

"Look," Muscarello shouted to Patrolman Reginald Toland, who was on duty at the station, "I know you don't believe me. But you got to send somebody back out there with me!"

Officer Toland kicked on the police radio and called in Cruiser 21.

Within five minutes, Patrolman Eugene Bertrand pulled into the station. Bertrand, an Air Force veteran, reported an odd coincidence. An hour or so before, cruising near the overpass on Route 101, he had come across a parked car. A lone woman was at the wheel. She said that a huge, silent, airborne object had trailed her from Epping, 12 miles away. It had brilliant, flashing red lights. When she reached the overpass, it took off at tremendous speed and disappeared.

Toland turned to Muscarello. "This sound like the thing you saw?"

"Exactly," said Muscarello.

### **Return to the field**

It was nearly 3:00 when Patrolman Bertrand, still trying to calm Muscarello, arrived at the field along Route 150. The night was clear, moonless and warm. Visibility was unlimited. There was no wind, and the stars were brilliant. He picked up the radio mike to tell Toland that he saw nothing but that the youngster was still so tense he was going to walk out on the field with him. "I'll be out of the cruiser for a few minutes," he said, "so if you don't get an answer on the radio, don't worry."

Bertrand and Muscarello walked down

(Please turn to page 219A)





**'SLEEK, SPORTY, WELL-MANNERED'  
DAN GURNEY TESTS:**

# **CHEVY'S HOT NEW CAMARO**

**W**HEN BOB CROSSLEY, PM editor, called asking me to test Chevy's new "personal-type" car, I recall being very much pleased at the prospect. Most of my driving these days involves the serious business of racing, so a chance to bomb a lively car around a closed course—with not another car in sight—figured to be fun. But I also remember hanging up the phone and wondering what in the world I had let myself in for.

It turned out I had let myself in for a most enjoyable and interesting driving experience. I wound up behind the wheel of a good looking, outstanding performer that immediately convinced me Mustang had a worthy competitor.

But back when Bob called me, I didn't know anything about the car—what it looked like, its power setup, suspension arrangement, brakes, steering . . . even its name. Ordinarily, I approach a strange (to me, anyway) car with caution. But this time I didn't have the usual new car apprehensions. I've known Chevy as a company long enough to realize its products—particularly a new car—would have all the right qualities. And when I first saw and drove the car (which had by that time been named Camaro) on the General

Motors Proving Ground at Milford, Mich., my realization was confirmed.

There were two models for me to test—a bright blue sport coupe and a cream-colored SS convertible. I thought both cars good looking. Oddly enough, the car's basic lines reminded me more of this year's Falcon than the Mustang—the car with which I suppose the Camaro will inevitably be compared (and not at all to its disadvantage, by the way). Anyhow, I liked the Camaro's sporty, bouncy look, and I remember thinking Chevy would have its work cut out keeping up with the demand for this one.

Chevy vehicle development engineer Bob Clift was on hand for the tests and he told me the coupe had a 327-cu.-in., 275-hp engine and a Powerglide automatic transmission, the SS convertible a 350-cu.-in., 295-hp engine with four-on-the-floor. Both cars had a 3.31 rear axle ratio, the convertible with positraction. The SS had disc brakes up front; the coupe drums all around. Firestone D70/14 Wide Ovals and a suspension handling kit were on the convertible; standard 7.35/14s and suspension on the coupe. Both had power steering.

I took two driving approaches for each



car—the first to circuit the course at normal street speeds, the second to get around as fast as possible.

For the tests, Chevy had staked out a course that included a series of sharp left and right bends known as “the Seven Sisters,” a long, sweeping curve to the right, and one fairly long straight. Bob Clift rode with me in the SS for the first couple of laps and we decided a little more tire pressure was needed before attempting any rough stuff. I added ten pounds all around and found this made a big difference in how the SS handled.

I gradually worked up speed, going through the bends as fast as possible, and discovered the Camaro to be a most forgiving car. It's not the least bit vicious, even as you approach its limit—that is, the limit as to how fast it can be taken through a given turn. It's no race car, of course; still, it retains its manners right through to the end of the line. And this, I think, is the criteria of a good handling car—one that tends to “forgive” driver

goofs, that isn't rude and harsh, and that has some flexibility left at the upper end of its limit.

Coming out of the turns and onto the straight, I rammed the accelerator to the floor and felt my head go back. Toward the end of the straight, a glance at the clock showed 120 mph. I realized I got up there with little or no fuss. I leaned on the brakes to re-enter the turns and the car hauled down smoothly and in a straight line. Only later, after a couple of high speed laps, did I encounter any sort of brake fade.

Back in the turns I managed to get a slight bit of rear end hop. But this is more or less to be expected and—considering that the car was getting a brutal workout—in no way reflects upon its good behavior.

Then I did a few timed acceleration runs down the straight and managed:

0-60..... 7.3 secs.

0-100..... 17.9 secs.

Top speed..... 118 mph

(Please turn to page 219G)



**CAMARO SPORT COUPE** proved a sprightly, all-around package for average driving use. If I were to buy one, I'd order the handling kit

**ACCELERATION RUNS** in the SS Camaro resulted in respectable times throughout the range. I hit 118 mph toward the end of a longish straight





**POURING IT ON** down this dusty straight after coming out of a fairly tight bend, I was impressed by the SS Camaro's manners in general. It tends to be a forgiving car and compensate for driver goofs







**Blackboard by wire** is the latest thing in remote classroom teaching. System involves sending instructor's voice, along with graphic blackboard material, over telephone lines for long-distance illustrated lectures. Instructor sits at transmitting console (left); students in class watch a TV monitor. General Telephone & Electronics makes the system.



**Giant coal shovel**, making a man look like an exclamation point in this picture, has just gone into action in the Bergheim/Erft "Fortuna" open pit mines in Germany. It towers 257 feet skyward and is longer than two football fields. In a single 20-hour period, the gigantic Krupp shovel-dredger is capable of digging out more than 100,000 tons of coal.



**Leaping Lizzie** that comes in a kit is the newest thing for people who like their transportation to spend 20 percent of the time airborne. If you crossed a Porsche with a Jeep, says the manufacturer, you'd get a Manx—which is what this is. Using a VW chassis (1961 or later) that you supply, you can produce this bouncing beauty with one of two fiberglass body kits. Maker is B.F. Meyers, Newport Beach, Calif.



# U.S. Warplanes in Vietnam


America's arsenal of fighting aircraft is now carrying the sky battle to the Vietcong in everything from supersonic jets to 90-mph 'Bird Dogs'

By KEVIN BROWN, PM's Aviation Editor

Illustration by Edward Valigursky

**A**N AIR WAR encompassing the whole panorama of combat aviation goes on in the skies over the swamps and sweat of Vietnamese jungles where much of the fighting is primitive, hand-to-hand guerrilla warfare.

Unarmed O-1 Bird Dogs skim the trees eyeballing targets for



the F-4 Phantoms and other supersonic fighters that streak vapor trails across the heavens. Valiant helicopters drop down into the jungle itself to unload a squad of fighting men or to hover just above the trees to reel in men who've been wounded in the fighting below. High above, huge B-52s move menacingly northward to rain destruction on strategic targets in Communist territory. There is hardly an aspect of air warfare that is not practiced in this strangest of all wars in Vietnam. Many of these tactics, and the aircraft that participate, are pictured on the next two pages by famous aviation artist Ed Valigursky in a painting commissioned exclusively for Popular Mechanics. The airplanes are identified in a chart on page 218. *(Text continues after the painting.)*

**AIR FORCE F-4 PHANTOMS** (above) streak across Vietnam jungle on low-level mission





VALIGURAY









**TWO F-105 THUNDERCHIEFS follow F-100 Supersabre on North Vietnam mission. Supersabre's radar can**

Almost every aircraft in the U.S. inventory has seen action in Southeast Asia. Most, but not all of them, are shown in the painting. It is more practical to speak of the planes in relation to their missions.

Foremost among the combat aircraft are the tactical fighters, the F-4s, the F-5 Freedom Fighters, the F-100 Supersabres and the F-105 Thunderchiefs of the Air Force; the A-3 Skywarriors, the A-4 Skyhawks, A-6 Intruders, the A-7 Crusader IIs, F-8 Crusaders as well as the F-4s of the Navy and Marines—all strafe and bomb enemy targets behind the lines.

Strategic bombings, notably by the B-52 Stratoforts, the B-57 Canberras and B-66 Destroyers, penetrate far beyond enemy lines to hit strongholds of the interior.

Probably the most surprising offensive weapon of all, however, is the amazing A-1 Skyraider, a prop-driven, tail-wheel plane that can trace its history back to the dive-bombers of World War II. Used by both the Air Force and the Navy, it has cov-

ered itself with glory—in an age of jets and supersonic flights—as one of the most versatile and durable of fighting aircraft.

A strange mixture of other aircraft, built for other purposes, has seen action in Vietnam. The F-102 Delta Dagger, an air-defense plane, has been used in close-support missions. And, of all things, the venerable C-47 Gooney Bird, a pre-World War II transport, has been fitted with guns and sent into the breach.

No history of the war would be complete without praise for the ubiquitous helicopter in all its models, the UH-1 Iroquois (the "Huey"), the CH-47 Chinook, the UH-2 Seasprite, the HH-43 Huskie and many more. The choppers deliver troops right to fighting areas, dodging bullets en route; they hover over the front lines spotting targets for ground and aerial weapons; some carry weapons of their own, strafing and firing rockets when targets appear. But, if the helicopters did nothing else, they would be enshrined in





pinpoint targets for F-105s through solid cloud cover

the hall of heroes for the job they do in rescuing wounded troops and downed fliers, often in the face of enemy fire.

Reconnaissance aircraft, like the Air Force's RF-101 Voodoo and the Navy's RA-5 Vigilante, take high-level or low-level photos at speeds as high as 1000 mph. The Army's triple-tailed OV-1 Mohawk is representative of the fixed-wing aircraft used in close-support roles, just as the Air Force's C-123 Provider is of transport aircraft, operating from small unprepared fields to deliver troops and equipment.

However, when the war is written, the one hero who might emerge above all others is the man who flies the unarmed Bird Dogs as forward air controller. The FACs are emerging as a legend in their own time, flying within eyesight—and gun-sight—of the enemy to direct their own fighters to the target.

It's a strange war when the big hero flies the slowest plane and doesn't even carry a gun. ★★★

NOVEMBER 1966



**NAVY A-4 SKYHAWK** is positioned for catapult launching from carrier in South China Sea. Carrier-based aircraft can attack anywhere in Vietnam



**ARMY HELICOPTERS** have become workhorse of Vietnam war, delivering troops, rescuing them and even mounting guns on their fuselages to attack enemy



**SPOTTER PLANES**, one of most underrated elements in Vietnam war, fly low, unarmed missions over enemy territory, pinpointing targets for jets to hit



I rode our newest...

# Polaris missile sub

The author takes you on a three-day shakedown cruise as a nuclear-powered, missile-launching underwater craft goes through its violent acrobatic paces hundreds of feet below the sea

By HANS FANTEL

**S**HEER SIZE STRIKES YOU FIRST. Somehow I had thought of submarines as compact bean pods. But this one, docked at Connecticut's New London naval base, stretched 425 feet—about the length of 1½ football fields. Her 33-foot beam and 42-foot tower confirmed the impression of massive bulk.

She—all ships are still female—was the USS *George Bancroft*, one of the Navy's newest atom-powered, missile-carrying Polaris subs. By special invitation of her skipper, Capt. Joe Williams, *Popular Mechanics* was to share a crucial moment of her career—a predeployment exercise before she joined the other Polaris subs that prowl the ocean depths as America's outermost guard.

Our mission had three objectives: 1. Fire a dummy missile, simulating an actual Polaris launch; 2. Torpedo a surface ship; 3. Execute deep-submersion maneuvers to elude a make-believe enemy.

The first call for action came after we'd been riding the surface for two hours.







**AUTHOR SCANS THE HORIZON** from bridge of USS *George Bancroft* before our newest nuclear sub dove on its Atlantic shakedown cruise



**CONTROL AREA** is enlarged cockpit, holding 12 men or more. Underwater maneuvers are controlled from here as airliner's maneuvers are in air

"RIG FOR DIVE!" the intercom bellowed, starting the diving sequence.

I had been standing on the bridge—the tiny observation platform atop the tower that houses periscope, snorkel and antenna masts. As the ship prepared to dive, the tall masts retracted, gliding noiselessly back into the tower—like the horns of a snail.

"LAY BELOW, SHUT THE HATCH," the loudspeaker ordered. I clambered down a long ladder, through a well-like shaft that funneled me into the sub's control area—a wide, horseshoe-shaped room with walls covered by dials, levers, knobs, switches, signal lights and TV-like display screens. Bathed in the red glow of dial lights, the room resembled a jetliner's cockpit, magnified to hold 12 men.

From the periscope stand at the center, the ship's X. O. (executive officer), Lt. Cmdr. David S. Cruden, watched his crew smoothly clicking off a prediveroutine. Along the left wall, three men checked a blinking monitor board which reported the systems status from various parts of the ship: reactor and propulsion plant, atmosphere control, electric and hydraulic equipment and ballast.

To the right of the periscope, radar and sonar crews were watching multicolored beams trace electronic oscilloscope images of our surroundings. Two men were leaning over a large table on which a spot of light automatically plotted our position on a chart.

But the heart of the whole control area is the helm. Don't expect to see a traditional brass-trimmed oak wheel with extended spokes for handles. The driver's seat on a modern sub looks exactly like the seats in an airliner. Small steering wheel-type "stick" controls, just like those on a big jet, work stabilizer and rudder controls, pointing the ship on its course. Push the stick forward and she noses down; pull back and she rears up on her tail. Turn the wheel left or right, and she changes direction accordingly.

Steersmen on surface craft may scan the horizons of the open sea. Sub drivers face a different vista. Compass heading, true course, depth, rate of dive or climb, attitude, rudder angle, trim angle, course and depth error, engine speed, true speed—these are the gauges crowding into the helmsman's vision. Even if he goes to the autopilot, these instruments never go unwatched.

The prediveroutine sequence is now complete. The ship is ready. "DIVE, DIVE," commands the intercom. The alarm horn howls in frantic whoops. Ballast valves



cracked like 40-mm cannon shots. Oddly, you feel almost nothing. No dramatic plunge—no crash dive as in the days of World War II. Gently, as helmsman Barry Doe nudges his control stick forward, the ship nods down beneath the surface. The shallow dive angle keeps the propeller from sticking out of the water during the first nose-down.

Suddenly the ship seems motionless. Surface waves no longer rock the keel-less hull. An eerie sense of stillness is the first sign that you are now submerged.

But all the instruments and electronic displays have come alive. Their pointers and beams swing off, trembling slightly as the ship—like a living organism—adjusts itself to the mounting pressure of its new environment.

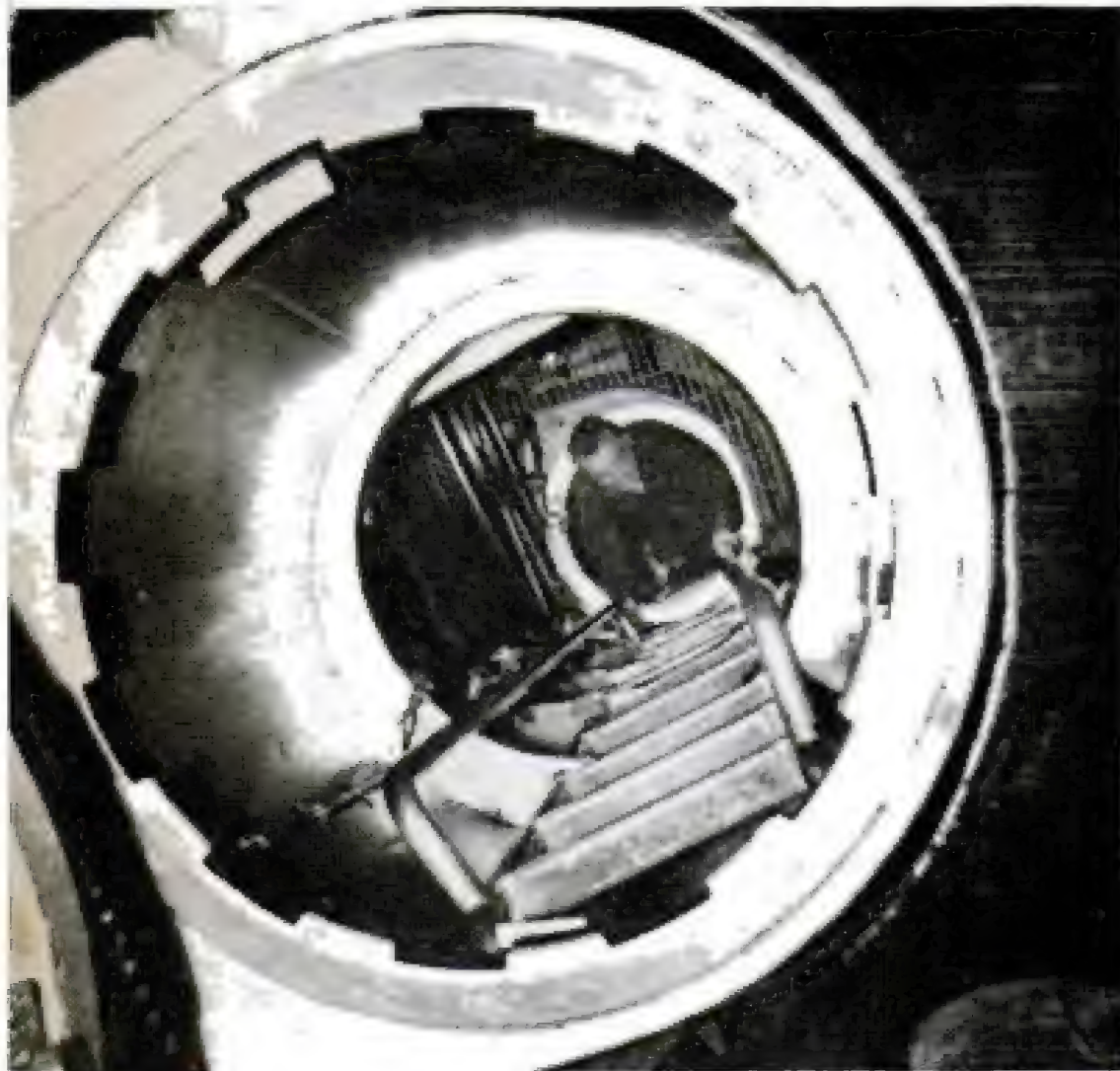
The next scheduled operation—as soon as we reached deep water off the continental shelf—was a series of violent maneuvers to test the ship's handling.

Again the X.O., who acts as a sort of deputy captain, commands from the periscope stand. Despite his studiously nonchalant attitude, you see the tension in his face.

In the back of his mind, every submarine navigator lives with two private horrors—he may joke about them, but the fear remains: running the ship aground during a deep dive and surfacing under



**OBSERVATION OFFICER** mans periscope as sub skims just below surface of ocean. With modern sonar, sightings can also be made easily without 'scope



**STAIRWELL** from bridge leads below to control area. Before dives, bridge is cleared of personnel, all masts are retracted into tower and hatch closed



**BATTLE STATIONS** are manned during tense moments of Polaris launchings. Automation and double checking makes accidental launch of missiles impossible



the hull of another ship. A quick glance at the fathometer reassured Cmdr. Cruden: 1500 feet from keel to sea bottom—plenty of room for acrobatics.

Our world tilted. Grabbing the nearest handhold—there's always one within reach—I hung on as if I were on the slopes of the Matterhorn. The floor tipped forward 30° as the sub burrowed down into its element. Spinning like the counter of a filling-station pump, the digital depth gauge raced to keep up with our plunge. All the Navy will let me say is that the sub goes down "more than 400 feet." Chalk it up as the understatement of the year. Even the X.O. admits, "That's just getting our ankles wet."

"RUDDER 25° LEFT. DEPTH 350," the next command rang out. Like a fighter plane in an air duel, the massive ship zoomed upward in a steeply banked turn. With engine at "Full," thousands of horses churned the water, pushing her up a steep slope to the ordered depth. Moments later, another command sent her plunging down again, this time twisting to the right.

My feet had lost confidence in the heaving floor. My hands clung to their holds; my eyes unbelievably followed the swinging instrument and screen displays as they registered the ship's extravagant motion. My head was busy, too, trying to conceive the vast power and magnificent engineering that let us "fly" an 8000-ton ship at crushing depth like a Piper Cub in the hands of an exuberant weekend pilot.

Normally, the ship would never have to perform such acrobatics. Its main job, in fact, is to provide a rock-steady undersea platform for missile launching. "But it's nice to know," says Capt. Williams leaning back in his chair and clasping his hands behind his head, "that you can twist your way out of trouble if an enemy trails you."

### Solid comfort

I had expected life on a sub to be about as comfortable as a ride on a rush-hour bus. To my surprise I found it no more cramped than tourist class on some airliners. Sure, three layers of bunks were stacked under a 7-foot overhead. So you couldn't sit up in bed. You went sideways through hatchways, and companionways were a collision course when a well-fed sailor came the other way. But aside from that, you had nearly all the comforts of home: Stereo music—just plug in your earphones, or, as an alternate program, you could listen to a recorded course in Russian. (You never know whom you might meet in international waters!) Feature movies twice a day in the crew's mess and a library of 1500 books (anything from Victorian novels to higher mathematics) let you forget you're isolated from the rest of humanity—that you're living in a tiny air capsule in the depths of a hostile sea.

Isolation is heightened by strict radio rules. For 60 days of unbroken submersion during patrol, the sub remains in radio silence. Any signal sent out might



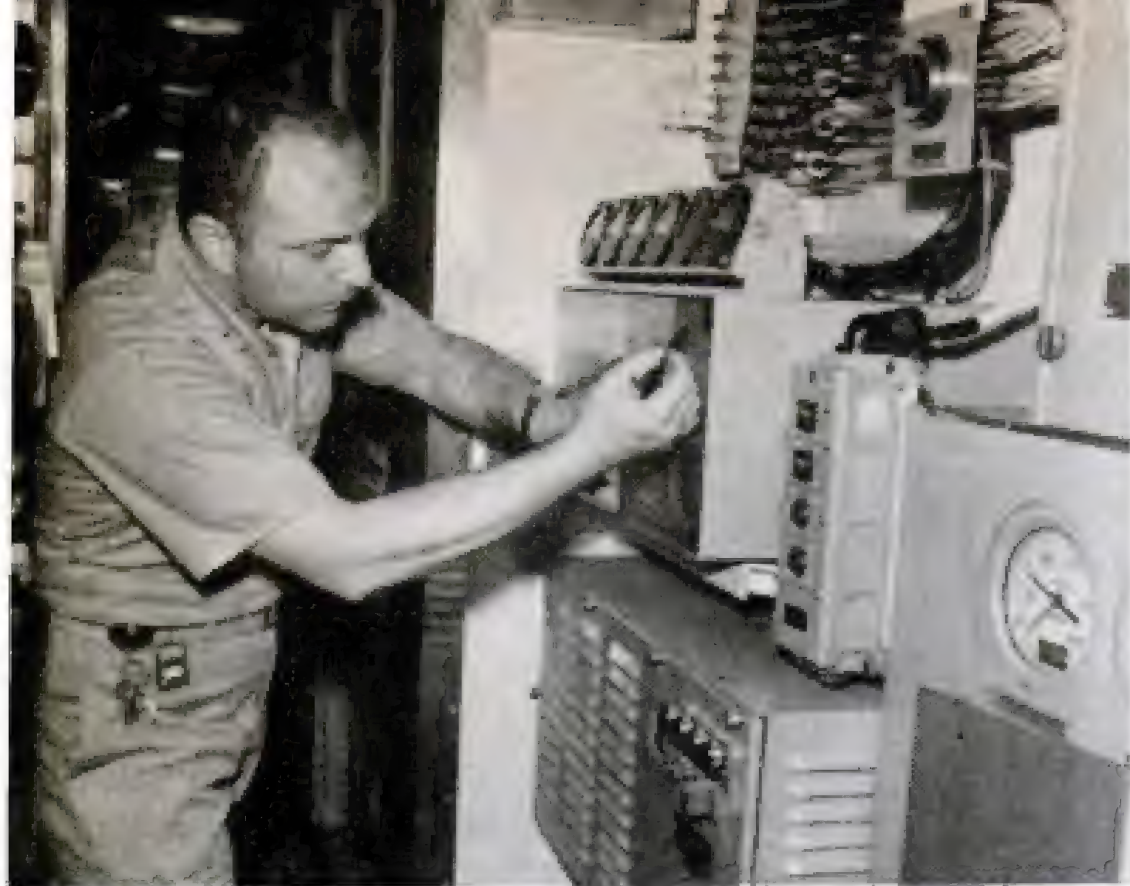
**TORPEDO CREW** readies "fish" for mock attack on enemy. High-pressure water ram pushes torpedo from tube, catapulting it out for run on target

NOVEMBER 1966



**TORPEDO LAUNCHES**, directed from control area, are much more tense than missile launchings because target is near and action can be watched on screens





**NUCLEAR SUBS** can stay at, or under, sea almost indefinitely. Chief limiting factor is amount of food on board. USS *Bancroft* has excellent galley

**SUB'S ATMOSPHERE**, checked here by officer, can be replenished with enough oxygen for crew by electrolysis of seawater, so breathing is no problem

betray the sub's presence to an enemy.

Yet even underwater, the sub almost constantly receives coded radio signals through a special Navy network serving the Polaris fleet on a worldwide basis. Personal messages, however, are held to a minimum; one 15-word "familygram" per month for each crew member is the official limit. If a crew member becomes a father while submerged, shore command allows an extra message to get the news to the sub. Other emergency messages are permitted, but not encouraged.

"It doesn't help a man on duty to know of a family crisis," says Lt. Joel Nobel, ship's surgeon doubling as psychiatrist to deal with the crew's emotional problems during their long spells of separation. "No matter what the home situation, down here he can't do anything about it." A by-standing sailor agrees: "If someone's sick or dead topside, I'd rather not hear about it till I get back."

#### **Day and night all the same**

We weren't due to reach our target until the next morning. But day and night have little meaning aboard a sub. The handpicked, volunteer crew (14 officers and 124 men—many of them highly trained technical specialists) work a 24-hour schedule: four hours on watch, eight hours off, twice a day; with the maintenance, repair and housekeeping to do in the "off" period.

The fluorescent glare always remains the same, except in certain areas where red lights at night give the crew instant dark adaptation in case of nighttime sur-

facing. In the absence of morning and evening, mealtime is the mark that divides the dayless-nightless flow of time. Chow is served every six hours: midnight, 0600, noon and 1800.

Between meals, heaping platters of cold cuts, assorted sandwich fixings, and a 24-hour coffee urn tempt crew members to take on extra ballast. The mess, always filled with off-watch sailors, resembles one of those all-night cafeterias, except when it doubles as an operating room in medical emergencies.

Since eating is the favorite pastime, the cook ranks next to the captain in importance. Aboard the *Bancroft*, Mess Chief Sadler (nobody knows his first name) is as much appreciated for his flavorful cooking as for his spicy (and highly unprintable) banter. "He gives us a mouthful and an earful," observes an admiring shipmate. "I'm best before mixed audiences," quips Sadler, "soldiers and sailors."

I had my first sampling of Sadler's cuisine—superb chicken Cacciatore—at the captain's table in the wardroom, where the atmosphere is one of cordial formality and the service as elegant as in a first-rank hotel. In a long after-dinner chat, Capt. Williams filled me in on the basic facts about his ship and its weapons.

Atomic subs are the first true under-seas craft, the captain explained. The older Diesel-electric subs he regards as "basically surface ships capable of submerging for relatively brief periods." Then they must surface or snorkel to

*(Please turn to page 242)*



# It's a flying surfboard

**“WATCH THE BIRDIE!”** and Vern Seifert did, only he concentrated on falcons who, in high-speed flight, tuck their wings in at their sides. So Seifert, who lives in Alaska and conducts hunting expeditions when he isn't building airplanes, designed a plane with its wings permanently “tucked in” so they're actually part of the fuselage. His apteroid, he says, maintains stability like a falcon. As one side goes up, the built-up edge acts as a spoiler, reducing lift without increasing drag, so the plane levels itself. He says the craft may have slow-flight applications, but he sees it as a prototype for supersonic transports.



**FLYING SURFBOARD** takes off in cloud of snow from strip near Anchorage, with Seifert at controls. Plane, wholly hand-built, is driven by 72-hp McCulloch engine



**SIDE VIEW** of apteroid, or wingless airplane, reveals surfboard-like fuselage. All controls, vertical stabilizer, rudder and elevator-ailerons are at the craft's rear

**UNDERSIDE VIEW** shows built-up edges of fuselage which give craft its stability in level flight. That's Seifert making adjustments to the engine on snowy strip





# Johnson's New Reveler

The name's the same, but from the waterline up it's a brand new boat. Here's the result of PM's own on-the-water tests

By ART MIKESELL, *PM's Boating Editor*



**DESIGN INGENUITY** has packed a lot of utility into the stern of the Reveler. Last year it was all engine box. This year there are two moppet seats concealing four good-sized storage compartments—two dry "stern boxes" and two insulated wells with lift-out plastic buckets. Note storage mount for an extra prop inside the engine box



**NEW COCKPIT** is all convenience. That beveled bow may not look salty, but it offers great visibility. New fold-down windshield has a full-width vent across the bottom





**STEPPING OUT SMARTLY**, the trihedral hull is quick to plane and soft riding. It corners with almost no lean

**D**ON'T GET LOST," called John Millard as the photo boat peeled off and idled up a narrow channel back to Sequoit Harbor. It was mid-afternoon, a blistering 102° on the Fox River Chain 'O Lakes (Ill.) where I was testing Johnson's 1967 version of the 16-foot trihedral Reveler runabout. With picture-taking out of the way, I was free to wring out the boat without worrying about camera angles or sun. So I shoved the throttle lever full-on and headed for open water.

When John first suggested this test, I wasn't too enthusiastic. I'd already run last year's Reveler and called it a fine boat. What more can you say? John's title in the Johnson Motors directory is Product Manager (Boats), meaning "chief boat honcho," so I could see some reason for his enthusiasm. But I didn't share it. . . until I saw the boat.

At first impression, it looks like an entirely new boat, more angular with rakish

GTO lines. Poke around the cockpit and you'll find all sorts of goodies that weren't there last year. More on this later.

The bottom, however, is the same trihedral found under last year's Reveler, and the 155-hp engine is only 5 hp more gutsy than last year's. (It's also available with 120-hp stern drive, incidentally.) With this basic similarity to last year's running components, I didn't expect any great change in performance characteristics. And there wasn't.

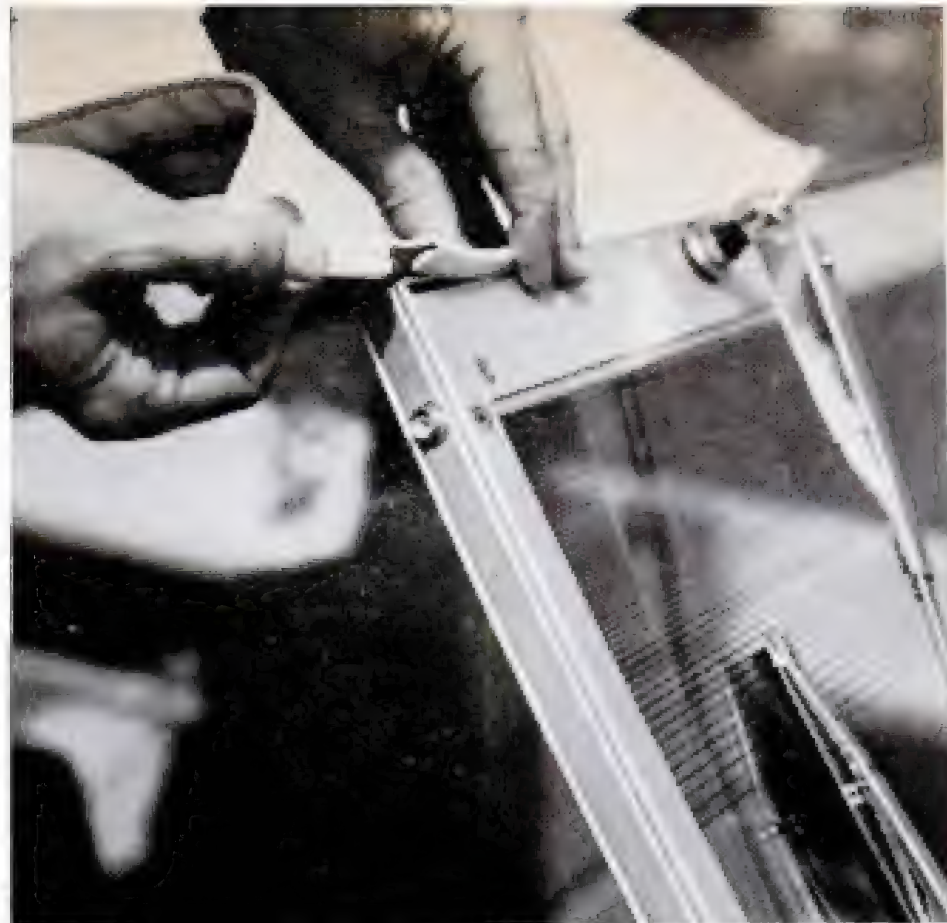
In my opinion, last year's Reveler was a great handling boat—stable, responsive, quick to plane, fast and soft riding in any reasonable water. This year's boat may even be a little better.

Shove the throttle forward and it kicks over on plane almost instantly. Acceleration is quick and sure. Like any of today's modified cathedral hulls, however, the trihedral bottom is a little sensitive to wind direction for top performance. Such hulls





**ADJUSTMENT CAM** on the top bows lets you make fine changes in the tension on the top. Just loosen the setscrew and reset the tension as necessary



**NO SNAPS** this year to mount the top to the windshield. Instead, the top has a lip which slips into a slot to avoid leaks. Note lines etched in windshield

gain extra lift from the air channeled into the tunnels, and will get up quicker and go faster when running into a moderate wind.

I tried two-way speed runs with the tach nudging 4500 rpm, just below the red line. Running with the wind, which was little more than a gentle breeze, the speedometer bobbed around the 40-mph mark. Against the wind, it climbed easily to 43 mph (which is what Johnson claims for the Reveler), and I think I probably could have gotten another mile or so above that if the lake had been larger. Running in a short chop at speed, the ride was soft and the boat felt solidly on track.

It also drops off plane quickly. Cut the power and you settle back into the water as if the brakes had been applied. Transition is much quicker than with a conventional hull. You really have to work to make this boat plow.

In wake crossings, the Reveler holds a line nicely and comes down with a soft squish, especially if you throttle back and power out at the right moment. Even when slamming it through full-bore, there's no bone-jarring impact. Of course the Reveler won't take really rough water like a deep-V hull, but it will take the bumps out of a good-sized chop and let you run at speeds that would be ridiculous in a flat-bottom or shallow-V hull.

Topside, there are all sorts of design improvements in the '67 Reveler. The most obvious probably is the vertical instrument console on the driver's right. It's ten

times as easy to read as the standard dashboard instrument group. And right above the control box, there's a handy cubbyhole with a good high lip for holding sunglasses, cigarets and other boating necessities. This is in addition to a glove box which looks about a yard wide.

The new fold-down windshield of tinted safety glass has variably spaced lines etched along the top to produce a sunshade effect. And the top now hooks into a slot in the upper edge of the windshield instead of snapping in place. No leaks.

The stern arrangement is all new this year. Seats have been added on either side of the engine box. The seat backs conceal deep storage compartments which run all the way to the transom. Underneath are lift-out plastic buckets in foam-insulated wells which drain into the bilge. Great for soft drinks or box lunches.

The Reveler isn't a low-cost boat, by any means, but it's a lot of boat for the price. ★★★

#### REVELER SPECIFICATIONS

Length	.....16' 2"	Width	.....7' 1"
Depth moulded	.....		36"
Weight: 120 hp	..1750 lbs.	155 hp	..1850 lbs.
Cockpit length	.....		82"
Cockpit width	.....		68"
Cockpit area	.....		39 sq. ft.
Inside depth: Forward	....24½"	Aft	....25½"
Capacity	.....		6 persons
Price: 120 hp.	.....		\$3850
155 hp.	.....		\$4125





**Rules of the road** don't apply to Gordon Yaeger as he closes the distance between himself and a Formula-3 racing car going 50 mph. The occasion in Brands Hatch, England, was not an official race but a demonstration of a rocket belt manufactured by Textron's Bell Aero-Systems, an American firm.



**Arriving at gate 2** is a Viscount airliner of the British private air company, Cambrian Airways. The plane was being tested for a hydraulic malfunction when it decided to take off on its own. Before coming to rest at the Speke Airport in Liverpool, it zigzagged around causing some damage, but no one was hurt.

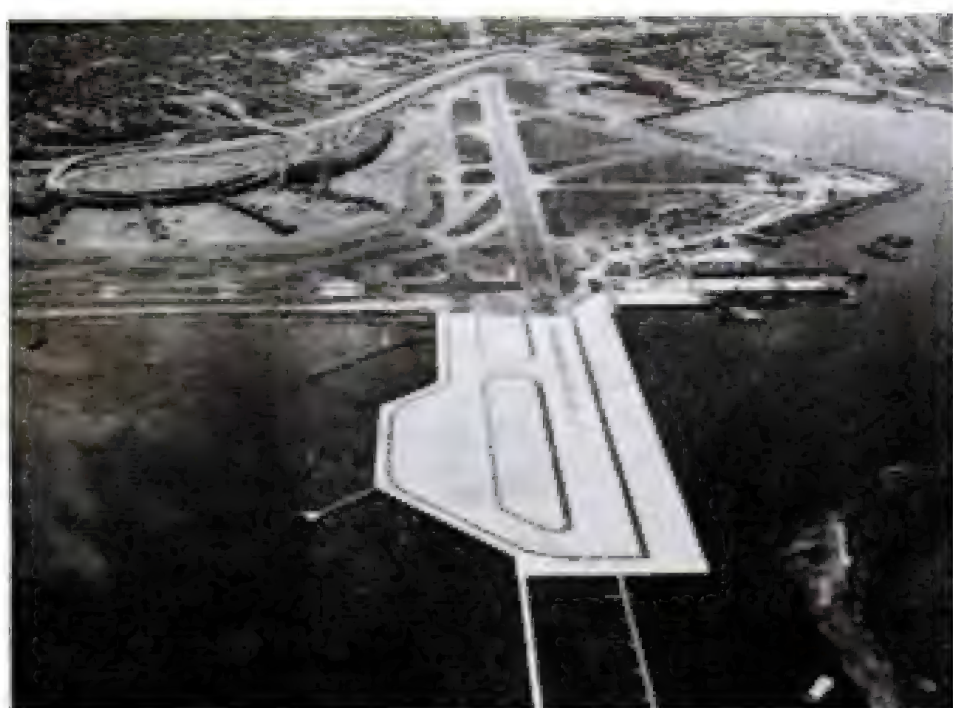


**Canteen-sized transmitter** is triggered to transmit any of 22 coded messages with the flick of a switch. The Litton Industries unit is called the Digital Message Entry Device, although the programmed transmissions can be switched out in favor of voice communications when necessary. Messages are received and unscrambled on field receivers which send an audible tone acknowledging receipt of the message.





**Unique "flying ship"** for antisubmarine warfare (ASW) is being built by Canada's De-Havilland Aircraft for the Royal Canadian Navy. The high-speed craft (also shown in scale model, left) features hydrodynamically designed bow and main foil systems. Bow foil, sheathed in steel, provides 10 percent of lift when ship is foilborne. Main foil provides 90 percent of the lift, houses power units for 14-knot hullborne speeds, 60-knot maximum foilborne speeds, even in high seas.

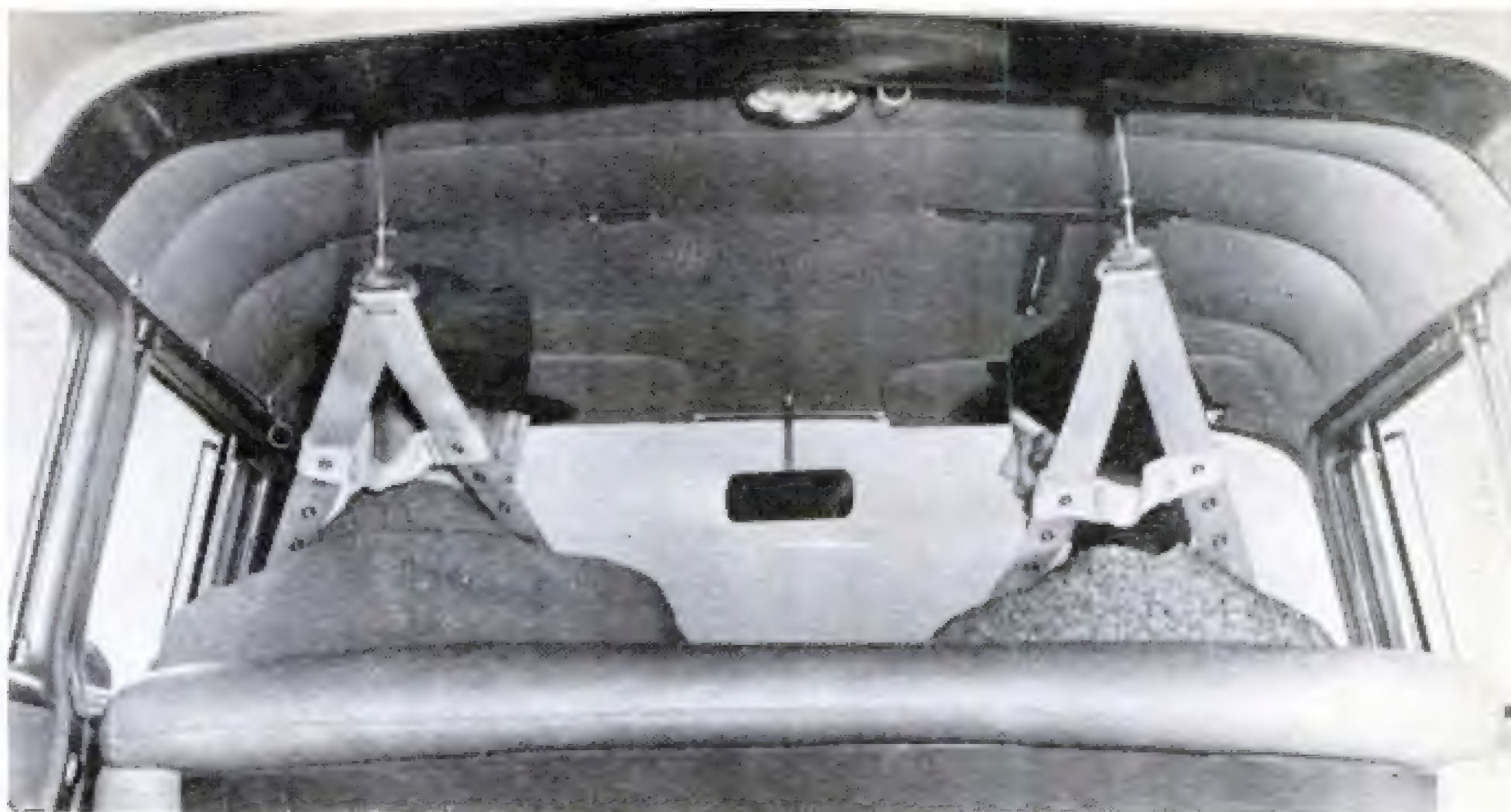


**Overwater runway** for New York's LaGuardia Airport is built on special pierlike structures able to hold up under pounding of medium and short-range jet aircraft. Project, as big as nine steamship piers combined, is built above surface of water (as opposed to normal fill-in) to avoid tidal flow problems.



**New snow vehicle** called Diablo Rogue features double track, front-end traction, and completely enclosed engine. Unit also has throttle control that, when released, brings Rogue to a complete stop. Speeds of up to 40 mph are said to be possible, even in softest snow. The Bolens vehicle weighs 360 pounds overall, is powered by two-cycle, 16-hp engine.

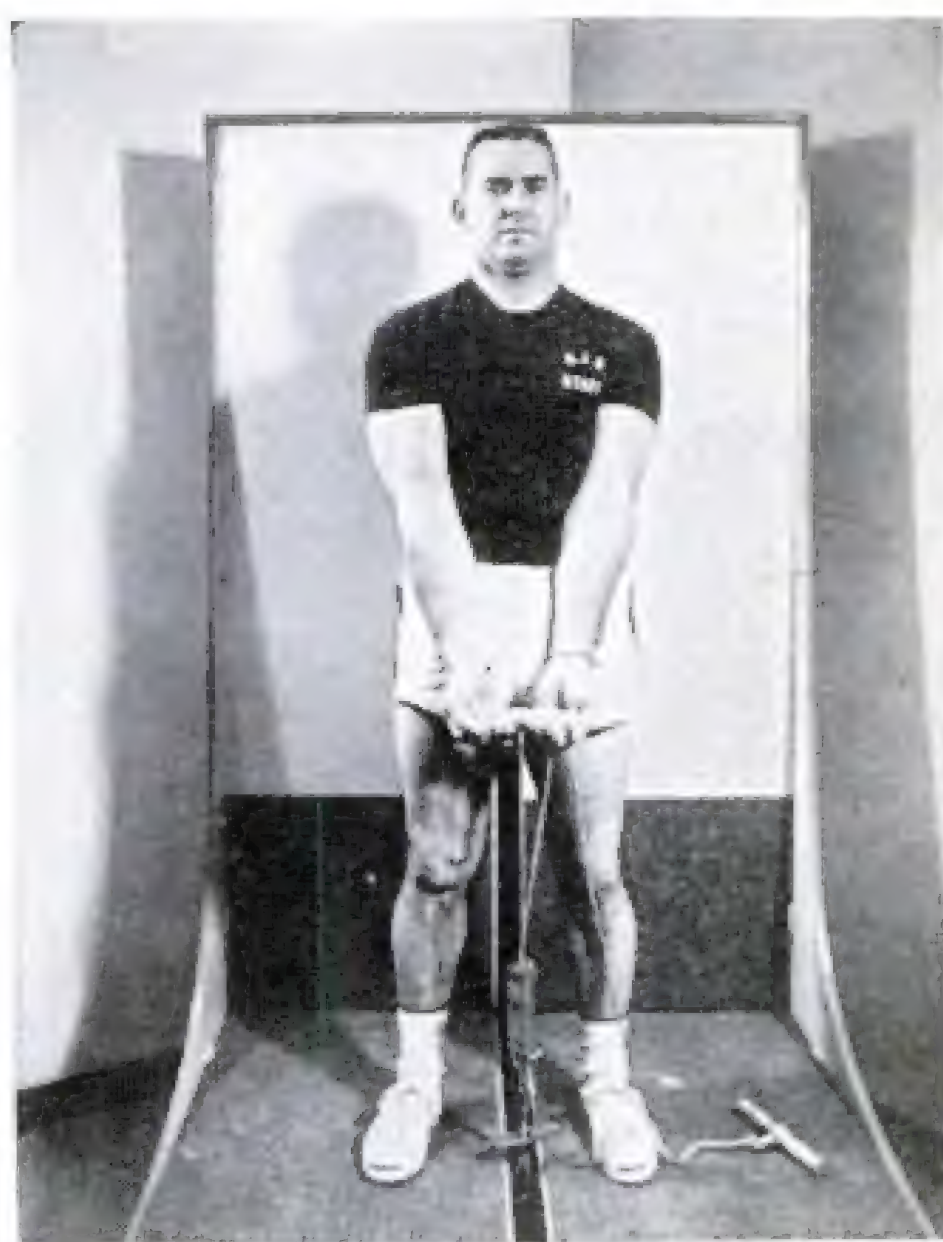




**Harness vs. seat belts.** A harness with a V-shaped yoke attached to the roof of the car is superior to a conventional seat belt, claims Andrew J. White of Lee, N.H., an automobile safety engineer. White has worn a harness similar to these models while hitting a brick wall at speeds up to 50 mph without injury.



**It's a space-age wake** that he's demonstrating. Like boats in water, space vehicles leave wakes in the electrons and ions through which they pass. Here an experimenter at Electro-Optical Systems demonstrates the relative positions of Gemini 10 and Agena vehicles during wake measurements conducted by NASA. Bright area at blunt end of Gemini depicts bow shock with slow-moving ions in space plasma.



**Weighing** less than two pounds and combining isometric and isotonic exercises, the Exer-Genie can duplicate all gym equipment, except the vibrators. First used by Coach Dean Miller of San Jose State College, it can be used by all members of a family for physical fitness.





# How to find sunken treasure *...and keep it*

Locating sunken treasure is a science. Here's how a successful treasure hunter taught me to spot coral-encrusted remains of galleons and advised me on the ins and outs of keeping booty

By LARRY STECKLER





**CORAL-ENCRUSTED CANNON** is sure sign of ancient wreck. Pile of ballast stone under cannon outlines ship on ocean bottom. All wood has rotted away



**TYPICAL DAY'S FIND** can be a double handful of silver pieces of eight. The value varies with condition of coins and actual silver content

**P**LAIN OCEAN BOTTOM slid past my field of view. Not a sign of cannon, ballast rock or rusty old anchors. For some time Jack Slack had been dragging me along behind his boat through the warm clear waters off Grand Bahama Island. I was getting the inside scoop from the experts on what it's like to search for sunken treasure.

Slack is a successful treasure finder. In June 1964 he and his partners uncovered what had once been glittering cargo in part of an ancient Spanish galleon.

Its value was estimated at over half a million dollars in gold, silver and historical artifacts! The treasure was recovered by Slack and three partners in 10 feet of water within a mile of the coast of Grand Bahama Island.

Right now the find is sitting in a bank vault pending a settlement between the partners. Meanwhile, Slack keeps busy operating sightseeing cruises and underwater tours of the beautiful coral reefs in the area. He is always keeping an eye open looking for the rest of that ship.

The wreck is only one of dozens of known Spanish treasure ships lost in the treacherous hurricane-swept Florida straits. The wide passage up through the isthmus formed a main route from Spain's rich mines in South America to the royal coffers in Madrid. In fair weather it was—except for pirates—a slick, "high-speed" marine highway often providing a substantial push from





**LOOKOUT PLATFORM** at bow of boat is designed to put observer out over water. Polaroid sunglasses eliminate surface glare



**DEPTH FINDER** is big help for staying in likely waters. The ships treasure seekers look for normally went aground in 10 to 20 feet of water when they hit an unexpected shoal



**READY TO DON SCUBA GEAR**, treasure diver stands out on transom at the rear of the boat. Platform makes it easy to get in and out of the water while wearing awkward scuba gear

the Gulf Stream. But in storms, it became a jagged, coral-reef-lined trap for literally hundreds of ships—many with treasure aboard. And a lot of that treasure is still there, buried in silt and encrusted with centuries of coral. The trick is to find it.

Slack, a personable, rugged, brown-haired man of about 40, like all treasure hunters, can recount every known detail concerning the most famous of all treasure fleet disasters. Eleven galleons, sailing from Havana on July 27, 1715, for Spain, and laden with an estimated \$14 million in South American gold and silver, were caught in a howling hurricane. On the night of July 30, one at a time, ten of the ships were dashed on the rocky shoals of the Florida coast and broken to bits. The general location of each wreck is known. The Spaniards retrieved about \$4 million of the hoard. Pirates

and treasure seekers have found a little more—no one knows how much for sure. But most of the remainder is still down there for the finding, and worth today many times its original value.

I was down there to learn, for *PM* readers, how the professional treasure hunters—like Jack Slack—go about the needle-in-the-haystack search for ocean-bottom bonanzas. We'd been out on the water all morning.

After giving me a few more minutes to watch the bottom, Slack cut the motors, and I pulled myself up out of the water. I was dressed in typical modern treasure-hunters' garb—wet-suit tunic, swim trunks, face mask, snorkle, fins and weights. I had been carefully, I thought, scanning the ocean bottom.

"Did you spot anything?" he asked.

"Nothing but coral. How come you quit so soon?"



"When you didn't see that anchor I dragged you over four times, I figured it was time to find out why," Slack said. "Watch a lot more closely. Look for something unusual. It will all be coral-encrusted, so watch for shadow lines—something that has straight geometrical angles or patterns to it. Nature doesn't make many things like that."

It was embarrassing, but I hadn't seen anything that even looked like an anchor. A few minutes later I was back in the water scanning the bottom with extreme care. Sure enough, there *was* an anchor down there. As you can see in the photo at the bottom of the page, it's a little tough to make out. It's just another chunk of coral bottom, but when you look a second time, it takes shape.

Later, back on board, I asked Slack where a greenhorn would *start* looking for a wreck.

"Try the library first," he replied. "There's not much sense looking for a sunken ship where you have little chance of finding one. Hundreds of books on piracy and sunken treasure, available in large city libraries, list many of the famous treasure-fleet ships that were lost—and even give approximate locations.

Most of the latter have been found and picked over, but hundreds were lost completely. A serious hunter would look up the old trade routes, ports of call and cargoes, checking marine maps of these areas to determine where such ships *might* have gone down."

I soon learned that few, if any, treasures were lost in deep water. Most of those found to date have been in 20 feet of water or less and within a bare mile or so from shore.

"These ships," Slack explains, "stayed as close to shore as possible for protection. When they sank, it was either in a storm that blew them aground on a reef or while coming in toward shore to escape a storm. Most treasure ships had a 20-foot draft or less and couldn't go aground in deeper water.

"Best place to look for an ancient wreck is in an area where the water unexpectedly shoals off. The barrier reefs are all happy hunting grounds."

His observation is borne out in many documented tragedies. One old galleon—the *Santa Margharita*—destroyed by a storm in 1595 with \$7 million in gold and silver on board, has been "firmly

(Please turn to page 211C)



**BALLAST ROCK.** Jack Slack picks up a piece from the bottom. Note piece of coral on the left. They often look alike to the eye, but a pick axe will tell



**ANCHOR OF TREASURE SHIP** is almost completely hidden by coral overgrowth. Careful inspection by eye revealed shape. It takes care to spot from surface





**They're not pulling the trigger . . .** only playing first and second Enfield. Bandmaster J.C.R. Brown of the Royal Marines invented this new salute to pipe Earl Lord Mountbatten aboard during a pre-retirement tour last year. He fitted bugle mouthpieces to Enfield .303 muzzles and came up with something akin to shrill kazoos.



**No commuter special this,** but a jet-powered test car that rocketed to a U.S. rail-speed record of 183.85 mph this summer. It's part of a New York Central experiment to determine if standard equipment can be run at ultra-high speed over standard track and roadbed. The run was between Butler, Ind., and Stryker, Ohio. (For a full report on high-speed trains, see page 89.)



**This is a Keetaarist!** That's a guitarist who uses a KeeTaar, a six-key device installable on any guitar. The new sound it makes is from vibrating the strings vertically. Without interfering with picking, it simplifies difficult passages.





# Our first 18 in space

Popular Mechanics salutes these valiant Americans who by reaching for the moon have made heroes of us all

By ROBERT P. CROSSLEY

Eighteen American astronauts have now made the perilous journey into Space. Several of them have made two trips. Each mission—whether one-man Mercury or two-man Gemini—has had a different assignment and has achieved a different goal. With a fourth group of astronauts now in training, and three-man Apollo flights possible late this year, America's space achievements will multiply and records will fall, thick and fast. (See quiz next page.)



Neil A. Armstrong



David R. Scott



Frank Borman



Charles Conrad, Jr.



Virgil I. Grissom



Alan B. Shepard, Jr.



M. Scott Carpenter



L. Gordon Cooper, Jr.



James A. Lovell, Jr.



Thomas P. Stafford



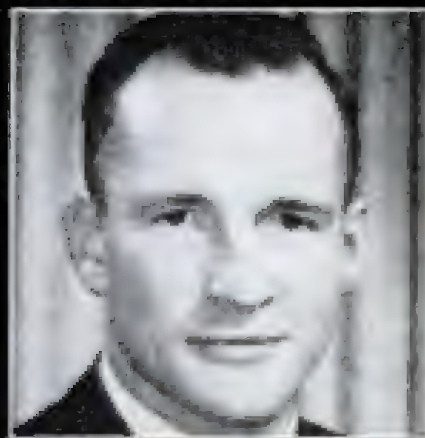
Eugene A. Cernan



John H. Glenn, Jr.



James A. McDivitt



Edward H. White II



Michael Collins



Richard F. Gordon, Jr.

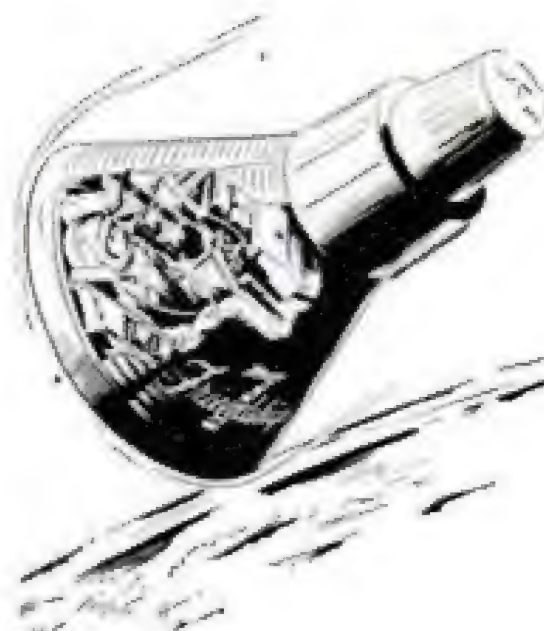


Walter M. Schirra



John W. Young





1. First American to ride a rocket off the pad:

- ☐ Gus Grissom
- ☐ John Glenn
- ☐ Alan Shepard
- ☐ Wally Schirra

2. First American to orbit the Earth:

- ☐ Gordon Cooper
- ☐ Scott Carpenter
- ☐ John Glenn
- ☐ Wally Schirra

3. First American to make two orbital trips:

- ☐ Gordon Cooper
- ☐ Scott Carpenter
- ☐ Gus Grissom
- ☐ Jim McDivitt

## Test your astronaut I.Q.

4. First American to walk in Space:

- ☐ Frank Borman
- ☐ Richard Gordon
- ☐ Edward White
- ☐ Charles Conrad

5. Completed longest space flight on record—14 days:

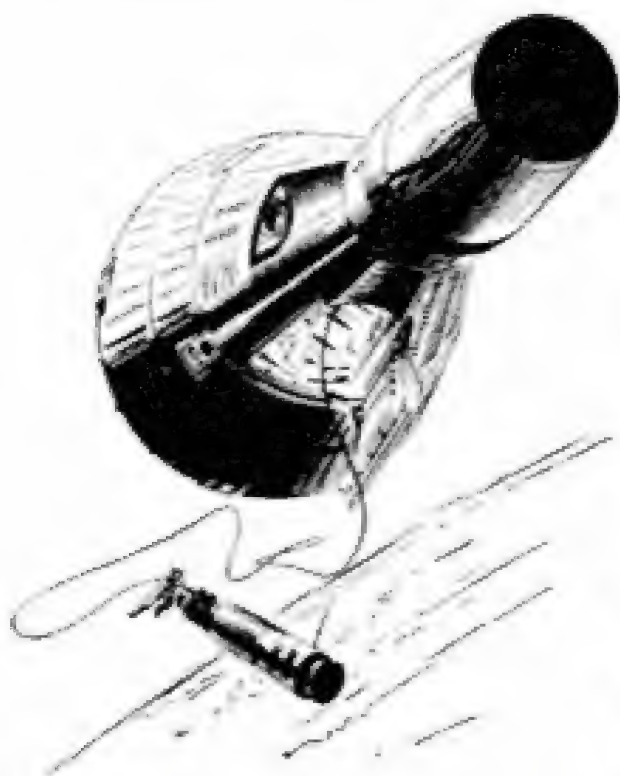
- ☐ Borman and Lovell
- ☐ McDivitt and White
- ☐ Young and Collins
- ☐ Schirra and Stafford

6. Made first two-man Gemini flight:

- ☐ Stafford and Cernan
- ☐ Cooper and Conrad
- ☐ Grissom and Young
- ☐ McDivitt and White







7. Walked in Space for nearly 2 hours, world's record:

- ☐ Charles Conrad
- ☐ John Young
- ☐ Eugene Cernan
- ☐ David Scott

8. Only Astronaut to also be an Aquanaut; spent 30 days on bottom of Pacific in "Sealab II":

- ☐ John Young
- ☐ Scott Carpenter
- ☐ David Scott

9. Orbited 476 miles above the Earth, man's highest flight:

- ☐ McDivitt and White
- ☐ Young and Collins
- ☐ Grissom and Young
- ☐ Armstrong and Scott

Just so you can say, "I remember when..." here's a chance to test your memory and your knowledge of who did what in the "beginning days" of the Space Age.

10. Brought Gemini capsule down to a "pin-point landing" within 3½ miles of carrier Wasp:

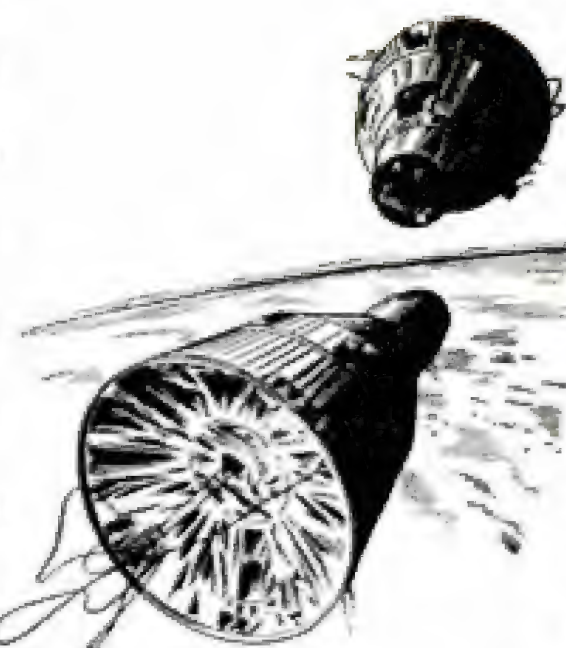
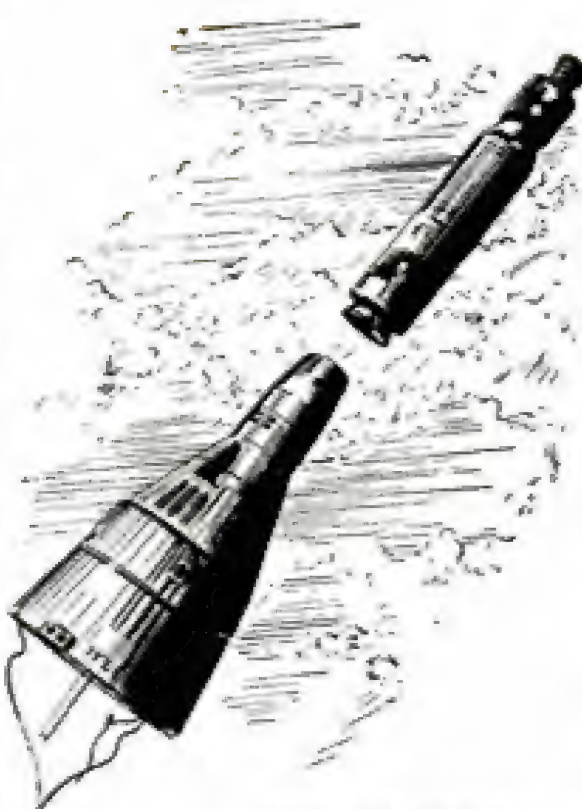
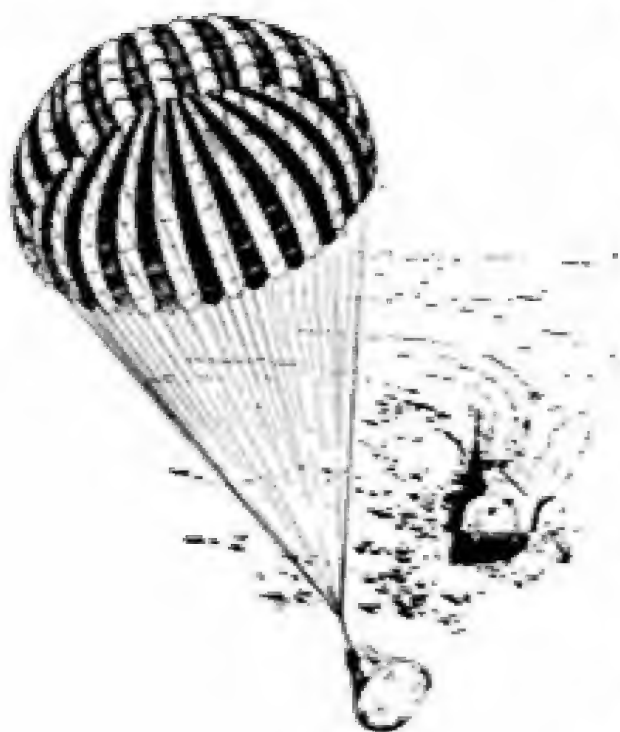
- ☐ Schirra and Stafford
- ☐ Stafford and Cernan
- ☐ Borman and Lovell
- ☐ Cooper and Conrad

11. First actual "docking" with another vehicle in Space.

- ☐ Armstrong and Scott
- ☐ Grissom and Young
- ☐ McDivitt and White
- ☐ Conrad and Gordon

12. First rendezvous and "formation flying" between two manned space vehicles.

- ☐ Grissom, Young and Cooper, Conrad
- ☐ McDivitt, White and Young, Collins
- ☐ Borman, Lovell and Schirra, Stafford



Illustrations by  
Fred Wolf

Correct answers  
on page 218.



# BIG WONDERS

## in small packages

By JOHN F. PEARSON

**W**ORLD'S DRIEST MARTINI is made by the National Cash Register Company. It's so dry you can hold it in the palm of your hand. It comes in the form of pellets as small as grains of sand. Pop them into your mouth and they melt on your tongue like so many chips of flavorful ice.

The "dry martini" is real enough—each grain holds a drop of cocktail—but it's only a stunt to demonstrate the remarkable capabilities of a process with the mouth-filling name of microencapsulation. Though it's really just getting rolling, the process already is responsible for a grab bag of unusual products: Here are some of them:

- A new form of aspirin that lets the drug seep into your system at a predetermined rate to provide a sustained effect you can't get with the ordinary tablets.
- Glues in stick form.
- Capsulized time bombs for fighting bugs.
- Bricks of gasoline that are easily stored and shipped—qualities that interest our military people.
- Atomic fuels in the form of pellets that require much less shielding



B




A



C

**LIQUIDS, SOLIDS—EVEN GASES—**may be encased by beads spilling from beaker (A). Solid particles are encased in plastic skins (B) and a bit of uranium-thorium fuel (C), magnified 750 times, has carbon skin





**Gasoline comes in bricks; aspirin comes in day-long doses; bug-killers come in time bombs. It's a new kind of packaging called microencapsulation, which may even help astronauts to stick to the outside of spaceships.**

**NOT SNOW—BUT MILLIONS OF CAPSULES** are spread over piece of glass held by Barrett K. Green, a researcher in the field. "The capsule is a natural structure," he says, "but you can play tricks with it"

NOVEMBER 1966





**CHUNK OF GASOLINE** slices like cheese. Squeezed in wringer, plastic cell walls will burst to release gasoline, which makes up 95 percent of brick



**MORE THAN LAB STUNT** is the burning of "solid" gasoline. In farm tests, bricks have proved useful in preventing frost damage to valuable crops

than big pieces of fissionable material. These pellets may be the key to our "Rover" space program.

Microencapsulation is our newest way of packaging; the first to come along, say chemists, since the aerosol can. Liquids, solids, even gases, can be encapsulated, put inside a skin of plastic, gelatin, starch or other material. The resulting capsules may be as big as a jelly bean or so small ( $1/25,000$  of an inch) that you can't see them with the naked eye. In use, the capsule's skin or wall can be broken through mechanical pressure, melted with heat, dissolved in liquids, "eaten away" by enzymes or even broken down by an ultrasonic blast.

Putting materials inside tiny, individual



**SQUEEZE THE PAD** against wall to release cleaning fluid from tiny capsules. A few wipes with pad will quickly remove all traces of crayon artistry

"cans" has advantages. You can turn a sticky liquid into a free-flowing powder; and if a "solid" would be even handier, you can press the powder into a brick. If the liquid happens to be a nasty-tasting medicine, you can swallow it in the form of a tasteless tablet. You can encase volatile liquids, like perfumes and food flavoring agents, so that they can be stored for years without appreciable loss of strength. You can use the process to enclose materials in a porous membrane permitting a timed release. Walls can be made so thin that up to 99 percent of a capsule is "payload."

As is the case with most technical advances, Nature got there first: the egg is a perfect example of an encapsulated





**HEAT OR LOW TEMPERATURES** can trigger the action that causes one liquid to form a skin around droplet of another, as can be seen in this photomicrograph



**COATING ON RIVETS** holds millions of capsules containing a rust preventive. When rivet is hammered into place, capsules break to release primer

liquid. And it was the desire to duplicate natural cell structures that led to man-made capsules, according to Barrett Green, manager of chemical research at National Cash Register (NCR) in Dayton, Ohio.

Back in the '50s NCR researchers were looking for a way to make a duplicating paper for business forms that would eliminate the need for carbon paper. They had in mind a paper that would carry its own ink.

"We went back to work done in Holland in the late twenties," explains Green. "At the University of Leiden medical school they had created polymer particles to use as models for biological systems. The synthetic particle has the characteristics of cell life and structure."

Years of work finally led to the process that now is so closely identified with NCR. Green, a soft-spoken man whose direct manner makes you think of a friendly small-town doctor, is quick to credit his colleagues, especially Lowell Schleicher, with having perfected the process.

"We had our ups and downs," recalls Schleicher. "When we were first starting out, we often accidentally encapsulated gases. We called them footballs."

Here, in brief, is how the NCR process works:

The material for the wall of the capsule is dissolved in water or other liquid. The stuff to be encapsulated can't be soluble, but it can be either solid particles or a liquid. If it's a liquid it will form an emulsion when added to the batch (the way salad oil forms droplets in vinegar). Then the wall material is made to separate out of solution and, as it does so, it forms around the particles or droplets. Finally, the newly formed capsules are dried and hardened.

Separation of the wall material can be triggered in different ways. "You can suddenly cool the batch, apply heat or change the acidity," says Green. "You can manipulate all the various elements involved, but natural forces do the creating. The capsule is a natural, simple structure. By playing tricks with it you can make it more complex."

There are other ways of doing the job, too. At the Southwest Research Institute, San Antonio, Tex., they use a centrifuge that shoots core pellets through a film of wall material. As the pellets break through, they become coated with an encapsulating skin. And at Battelle Memorial Institute in Columbus, Ohio, another center where a lot of research in this field is being done, they use a "fluidized-bed" method. Core particles in a container are kept in furious motion by a blast of air or gas. The coating material is introduced in the form of a vapor, and it reacts and clings to the core particles, forming capsules.

The best known encapsulated product on the market is NCR paper. Look in your wallet and you may find a sales slip made out on NCR paper. In addition to department store receipts, the paper is used for airline tickets, many kinds of office forms and for automatic print-out machines.

There's no carbon to bother with and

*(Please turn to page 232)*





**Trimaran sailboat**, with "swing wings," is latest thing in British boating. The main hull, bulky on top, tapers away to a slim form below the water line and is stabilized by the twin floats carried on steel arms. The floats are filled with buoyant foam, so that even if they or the hull develop leaks the boat will still float. For sailing, the floats extend outward. For motoring with the boat's auxiliary engine, or for docking, the floats are tucked in to the hull as shown at left. Called the Matamona, the boat is built to individual order with accommodations for six, including galley and sleeping quarters.



**Chemical light**, providing instant illumination without electricity, fuel, heat or flame, is now available for emergency situations. It operates simply by exposing the active material to the atmosphere. First adaptation is to aircraft emergency devices, such as the inflatable escape slide (at far right), to illuminate it in the dark. Other uses are expected. Various formulations of the basic chemical control the amount of light released, as well as its life span. Maximum illumination is about 500 times brighter than average highway in moonlight. The two models hold sheets of the chemical light in darkened rooms.







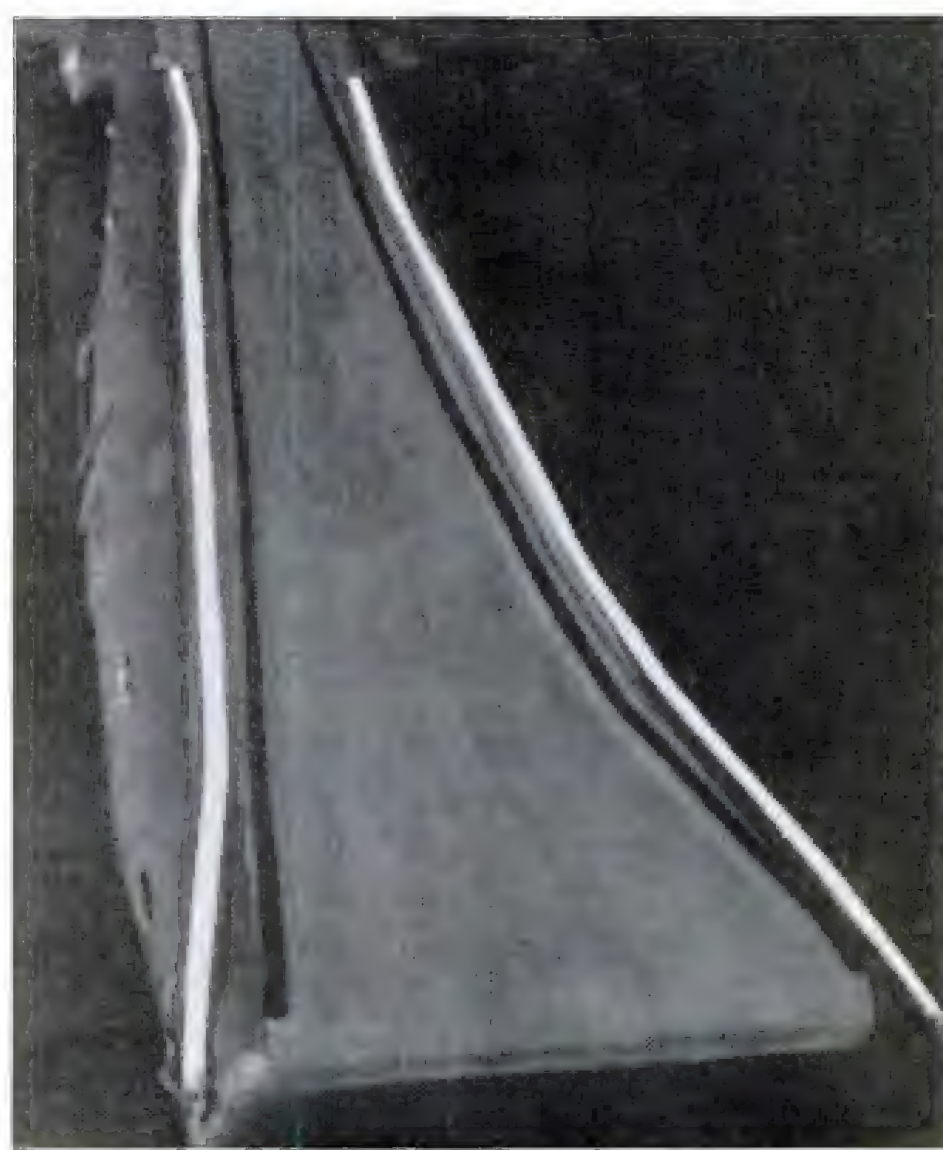
**Machine loans** make borrowing easy. Members of a credit system in Tokyo can borrow up to about \$55 by simply inserting a numbered credit card in a slot. The machine processes the card, checking its authenticity, then dispenses the cash in an envelope. The loan is repayable over a three-month period at an interest of 5½ percent. The machine is in the Ginza shopping district.



**Children's calliope**, which reproduces sounds of the classic instruments used by circuses and carnivals, is now available for home use. The miniature band organ uses a patented electronic wind system to produce the unique sounds of the calliope. Decorated in circus colors, the machine is expected to find use in schools as well as homes. It's made by Rocky Mount Instruments, Inc.




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WHINING HORSEPOWER and flying spray mark a tight turn during Salton Sea's annual 500-mile race grind.

# Salton's Savage 500

It's 125 laps of brutal punishment for men and boats, but every year the nation's top marathon drivers flock to California on Veterans Day for this wide-open scramble

By THOMAS E. STIMSON JR.

THE DRIVERS of some boats wind up with bloody backs after running in California's annual Salton Sea 500-mile endurance race. Vibration rolls their shirts up tight and the cloth cuts deep through the skin. "This in spite of a padded driver's seat that rests on shock absorbers," says two-time winner Rudy Ramos.

Jim McIlwain, who won last year's outboard division of the race, says the salt and alkali spray leaves a film on a driver's goggles that virtually blinds him. "Some drivers carry a wet chamois to wipe away the scum," McIlwain says. "Others prefer to race with no protection. Those are the guys that can tolerate a stinging face and burning eye-





balls." Jimmy Clinkenbeard, another winner in outboard class, says it's important to bolt the big fuel tanks down tight. "Otherwise vibration loosens a tank and it twists around. Then a leak can develop and fuel will spill into the bilge. Suddenly, there might be a fire or a boat could blow up."

Parnelli Jones, one of several Indianapolis drivers who has competed at Salton Sea, says the physical beating a driver takes in the eight or nine hours is far worse than wheeling an Indy car. "Slamming through the chop at around 100 mph is like driving a race car with no springs at all."

Would you believe the race is for fun?

That's the claim of upwards of 100 of the nation's best drivers, all of whom look forward each year to Veterans Day weekend in early November. They swear they enjoy every minute of the pounding, grueling race.

Some hardy souls drive all the way, hour after grueling hour. But most are glad to trade off with a relief driver when they come into the pits for a fuel stop.

(This classic of endurance racing is held over three days. Qualify on Friday, race four hours on Saturday, finish the 500 miles on Sunday. Course: four miles around a triangle. Two classes: inboards and outboards. One hundred boats in all may qualify. Crowds of



**OVER-STRESSED HULL** just plain gave up following hard pounding during last year's race. Proper balance of power and hull strength is vital in long race



**OFFSHORE RIGS**, upper left, serve as pits for inboard boats. Rough water, high winds often make re-entering race a hairy affair following stop for repairs



**SLASHING THROUGH WAKE** of a slower boat, Glastron's racer-president Bob Hammond heads outside to pass. Powered by Ford 427, the 17-foot boat came in third



60,000 and more watch the annual event.)

Last year's race was the roughest and wildest in Salton Sea's history. High winds blew the course markers away on Sunday morning and the race was delayed while they were replaced. When the race finally started, the boats thundered through the rain and chop around the first turn and into mass confusion. Visibility was so bad many drivers were missing the turns, and again the marker buoys began drifting away. The race was stopped until patrol boats flying large pennants were moved into place as turn markers. A helicopter that all the boats could see led them through the first few laps.

By the time darkness ended the race a few laps short of the goal, two boats had burned, several had flipped in the rough water, and others were swamped. Several boats sank after hitting debris, and a runaway boat with faulty steering cut another boat in two.

But aside from the thrill of racing, there's another reason why this long-distance marathon attracts the attention it does. (It isn't the money, for the winner gets no more than \$6000 of the \$25,000 at stake. A good endurance boat costs from \$7000 to \$10,000. There's an entry fee of \$100, and incidentals add up to another several hundred. Not even the winner gets rich!) The added big factor is the chal-

lenge that's presented by the wide open rules. Hulls must be at least 13 feet long, less than 24 feet. No superchargers or hydrofoil units are allowed. But aside from these stipulations, anything that passes the technical safety committee is okay. The result is that engineering talent and mechanical ingenuity get a real workout.

There are other rules, such as the toughie that says drivers who are not present at the beginning of the pre-race drivers' meeting are disqualified and may not compete. This rule is enforced right down to the last second, as Astronauts Gordon Cooper and Gus Grissom learned last year. Towing their 23-foot twin-engined "Miss Firebird" across the desert, they ran out of gasoline and arrived at the drivers' meeting a mere five minutes after it started. They were automatically disqualified, yet were good enough sports to make an appearance and run their boat throughout the first day.

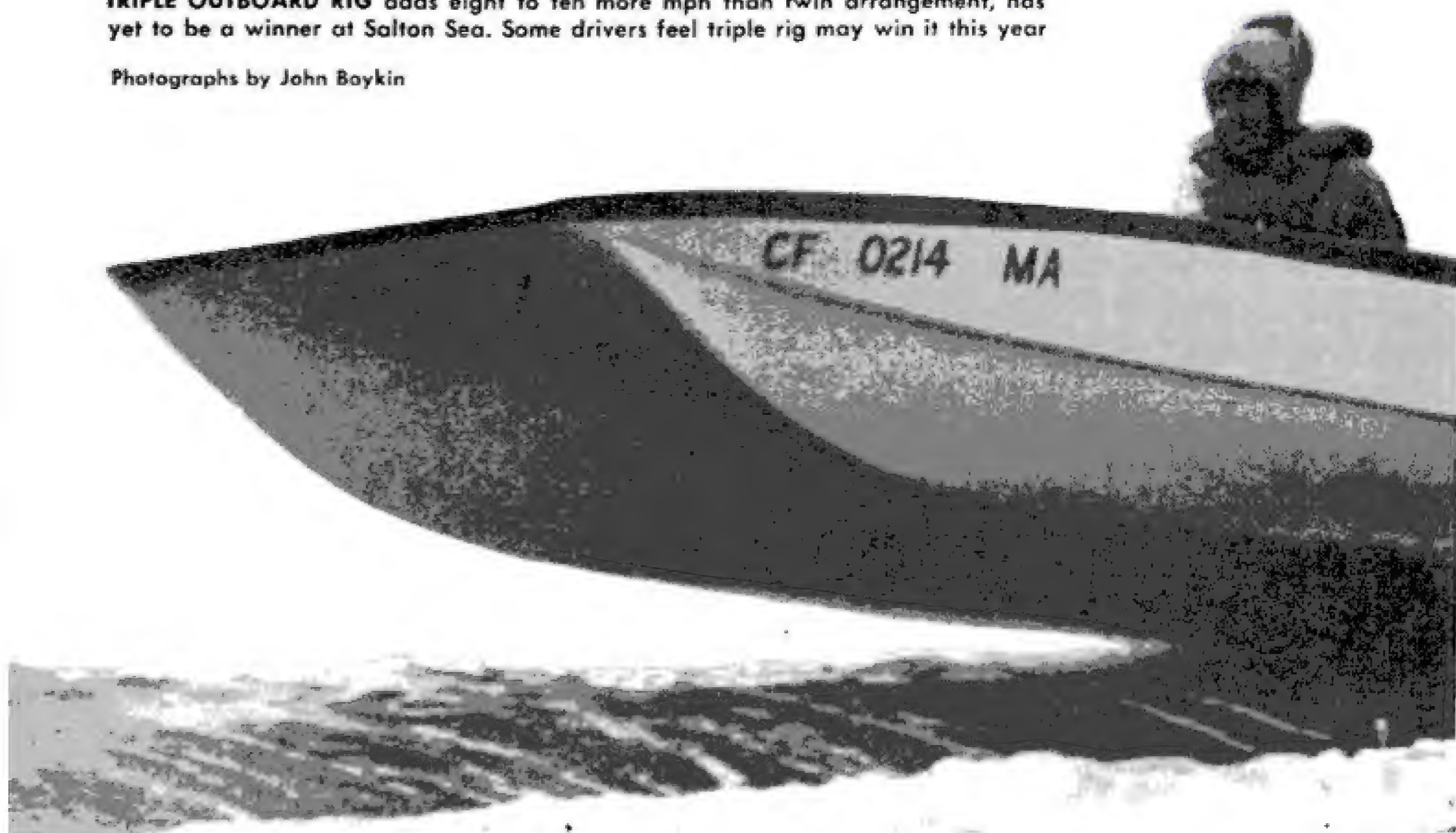
Most of the usual methods of putting together a winning boat don't apply in endurance racing. The familiar horsepower-vs.-weight formula bogs down when a light hull is loaded with 100 gallons (650 pounds) of gasoline. Carrying this weight, a light hull can become weak and is apt to break apart when it hits a wave.

A fast sprint boat isn't the answer,

*(Please turn to page 236)*

**TRIPLE OUTBOARD RIG** adds eight to ten more mph than twin arrangement, has yet to be a winner at Salton Sea. Some drivers feel triple rig may win it this year

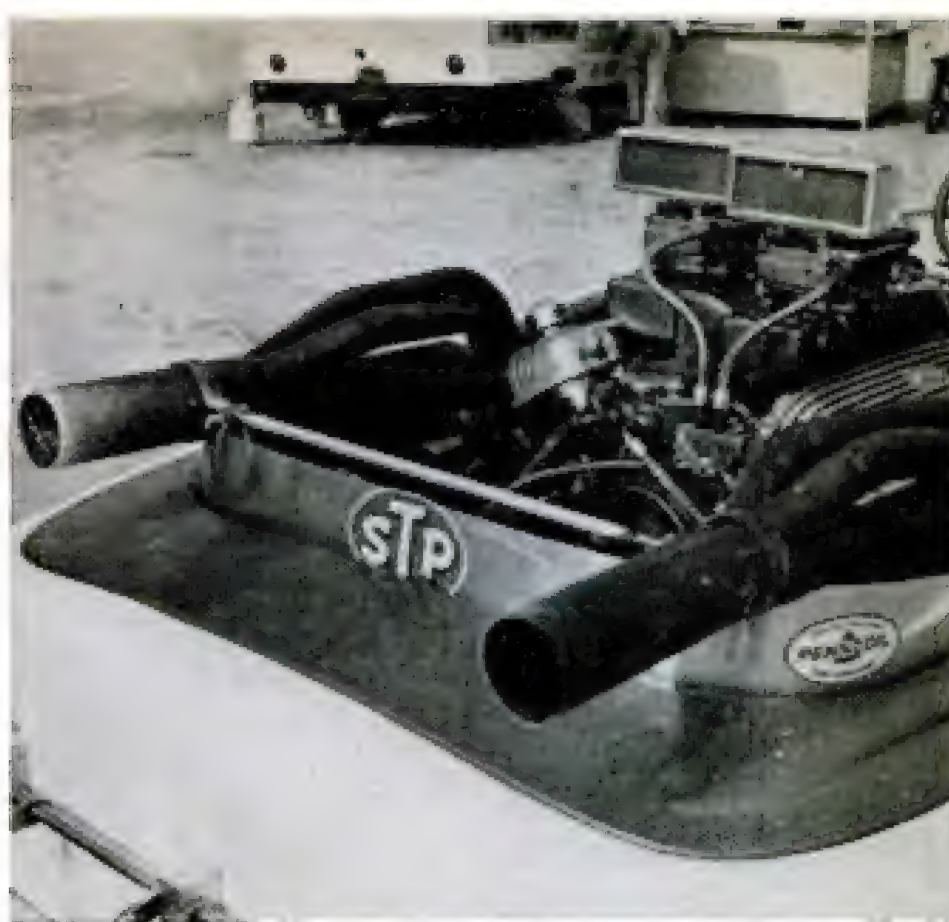
Photographs by John Boykin







**WINNING OUTBOARD FORMULA** so far has been a pair of engines. Here, mechanic makes a few last minute adjustments before lashing down everything



**MEAN AND NASTY-LOOKING** is this snarling inboard. There is no hp limit in Salton Sea race. Anything goes except blowers. Powerplants must last 500 miles



**PLANING PLATE** serves as extension of boat bottom, can be adjusted up and down during race by driver. Cranking plate down tends to raise stern, lower bow



**TWO-TIME WINNER** Rudy Ramos in his Allison-powered inboard gives last-minute instructions to crew before roaring away to win last year's Salton 500





# NOW WE'RE MINING OIL FROM MOUNTAINS

America's petroleum reserves are dwindling, but the biggest bonanza is still to be tapped—tremendous oil-shale deposits in the Rockies. And they've found a way to cook the oil from the rocks with hot marbles

BY JOSEPH N. BELL

Illustration by Howard Shafer

**A**N OIL COMPANY EXECUTIVE IN COLORADO said: "We're dead serious about extracting oil from shale. I know we've got a winner now. This region may become a new Klondike."

A waitress in a De Beque, Colo., roadhouse: "I just don't believe it. We've been through all of this twice before. Nobody's excited this time."

A government geologist: "All of us are convinced that oil from shale is bound to come in. It's not a matter of if but *when*."

A filling station operator in Rifle, Colo.: "I've heard this song before. I'll believe it when I see it."

The point of contention is a multibillion-dollar vein of mineral deposit in western Colorado and eastern Utah that contains some 3 *trillion* (a 3 followed by 12 zeros) barrels of oil, of which experts estimate about 500 million barrels are recoverable.

It isn't quite that simple, however. Mining and processing the shale that contains the oil is both expensive and complicated. Twice oil shale seemed on the verge of a breakthrough—in the late 1920s and immediately after World War II. But the first boom was broken by the discovery of the East Texas oil fields and the second by relatively cheap oil imports.

Now, say the oil experts, things are different. American petroleum reserves are dwindling and domestic needs increasing. Conventional fields will be unable to meet that increased demand in another decade or two. And it is dangerous for America to depend on foreign oil. Therefore, the time

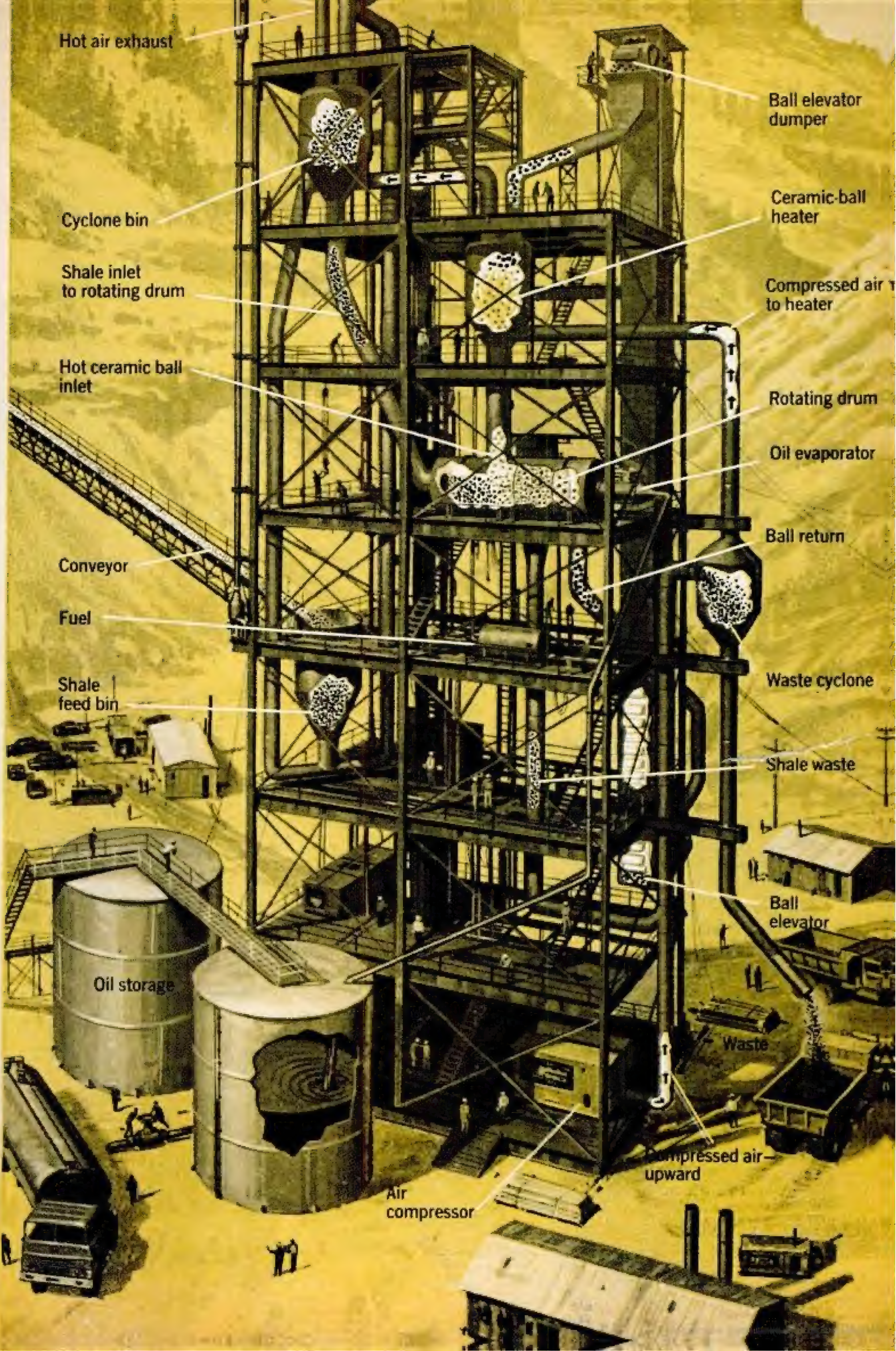
**HEART OF TOSCO'S HEAT-EXCHANGE PROCESS** is the rotating drum, shown near center of artist's conception (right) of rig. In drum, pieces of oil shale and ceramic balls, heated to 1200° F., are whirled and tossed together. The balls pulverize and heat the shale, driving off oil in the form of vapor

Shale mine

Shale feed chute







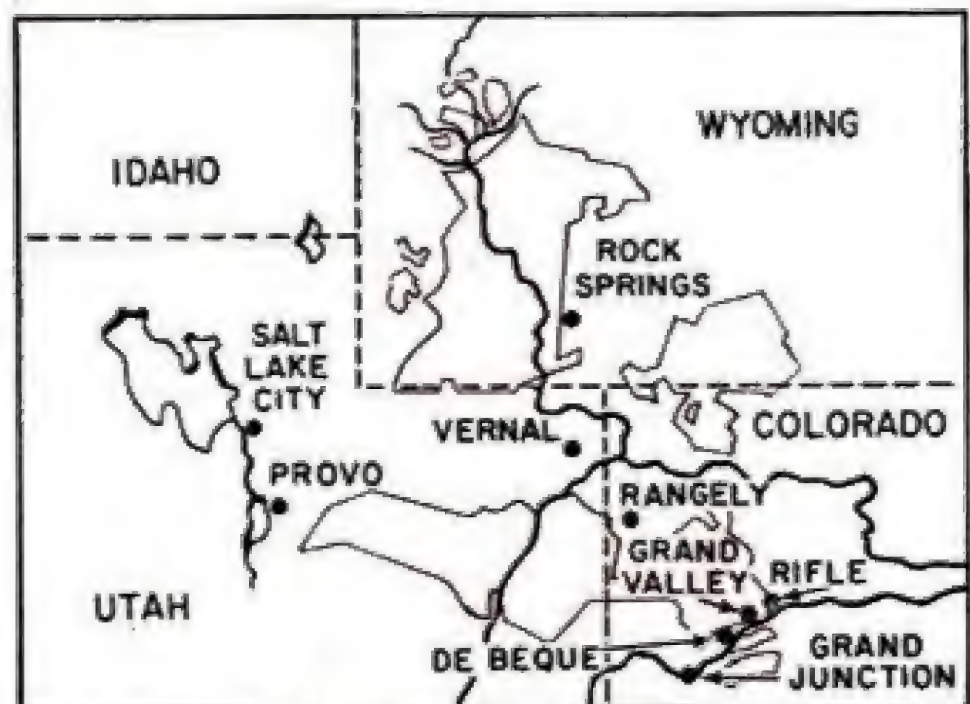




may have come for a serious, all-out effort to develop Colorado's "mountain of shale" that holds within it oil deposits some 30 times greater than all the fields of Oklahoma and Texas and five times greater than the proved petroleum reserves of the world.

The people who live in the oil shale area—twice seduced with boom-town talk—can be forgiven their cynicism. Everywhere around towns like De Beque and Rifle can be seen evidence of an aborted boom. A tired, pockmarked sign that reads "Motel Area of Planned Oil Shale City" stands lonely sentinel over a vast vacant lot. Another sign promoting plots "restricted to business, \$750 and up" has long since stopped attracting business. De Beque, once planned for 15,000 people, has a population of 185, living mostly in clapboard houses that need paint.

But these are the superficial signs that embitter the residents of the area and convince the casual traveler there is little real action taking place. Behind this facade, however, activity in the oil shale



**THOUGH THERE ARE OIL SHALE BEDS** in many states, buried here is the world's greatest concentration

**MEN ARE DWARFED BY 190-FOOT TOWER** in the rugged Colorado hills. Though operations are secret, plant reportedly processes 1000 tons of shale a day



industry has stepped up appreciably—and become enveloped in a shroud of secrecy.

Looking over the area, I was stopped at two different locations by armed guards on back roads that lead to plant sites where oil companies are working around the clock to come up with a successful and economical means of extracting oil from shale. At a third site, one operated by the government and now on lease to six oil companies, I caught a glimpse of an experimental plant in operation but was not permitted to go in and look at it.

Why the secrecy? Because billions of dollars are at stake. The company that first comes up with a viable process will have a clear jump on the rest of the industry—and that time finally seems close at hand, in spite of the doubts of the residents of the oil shale area.

How close? Officials of the Colony Development Co.—a combination of The Oil Shale Corp. (TOSCO), Standard Oil Co. of Ohio and the Cleveland-Cliffs Iron Co.—won't say. Only two years ago The Oil Shale Corp. predicted commercial pro-

duction as early as 1967. Now, however, company spokesmen refuse to be specific because they "don't want to be wrong again." But one TOSCO official points out that "the mining has been licked below the crucial figure of 50 cents a ton and we have solved the principle of heat exchange without combustion. We're going to make it, and soon."

### Secret operation

Colony presently has the only domestic plant that can be converted to full-scale production. It uses a system for extracting the oil that is unique, cuts loss of oil to a bare minimum, but apparently contains some bugs that haven't entirely been worked out. The company isn't talking about the exact nature of the problems or how they are being solved. But 100 men are keeping Colony's "semi-works" plant in constant and secret operation, now processing 1000 tons of shale a day to test out fully a system that will be expanded to 8000 tons a day as soon as technicians are sure it is ready. Eight

*(Please turn to page 220)*



**AFTER MINING**, shale is crushed and carried by conveyor to processing tower. Heating produces a substance called kerogen, from which oil is refined

NOVEMBER 1966



**MOUNTAIN RICH WITH SHALE** is part of the Rockies. Shale deposits are the light, steep-faced strata situated below darker layer at top of the mountain



**OIL SHALE** is multilayered sedimentary rock long recognized as a good source of fuel. Indian legends tell of mountains being set afire by lightning





**Old and new.** Rear-engine jet transport, the VC-10, flies over a flying replica of a 1915 World War I biplane, the Vickers Gunbus. The VC-10, a long-range subsonic troop carrier, is the latest in a long line of Vickers aircraft for the Royal Air Force. The Gunbus is one of the oldest.

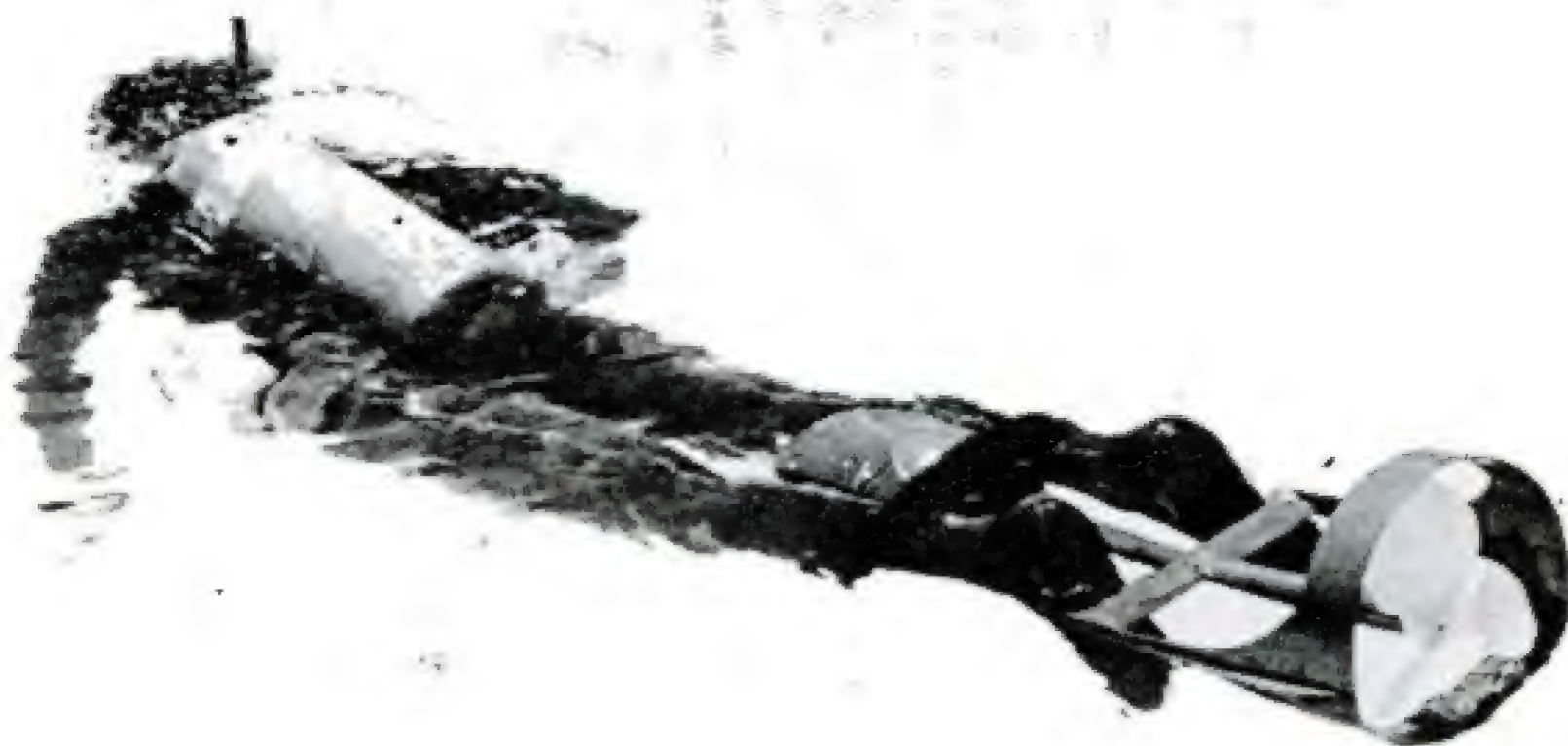


**Boy finders.** British boys may never get lost now. They're wearing shoes with a compass in the heel. In addition, the soles make animal tracks, including the badger, deer, hedgehog, red squirrel, sheep, otter, and fox, with a compass rose on the outside heel. The real compass is inside. The British Boy Scouts have approved the shoes for use in the field.



**Light-footed spaceman** tests space suit with the help of a device that simulates one-sixth the pull of gravity—the force on the moon. The tests were to check the mobility of the suit under lunar conditions, using a Lunar Excursion Module mockup.





**U-drive human outboard** propels skin divers around the water at about 2½ mph for as long as an hour and 15 minutes. Created by an engineering student at Stanford University, the "Pogo-Prop" consists of a small tank containing an electric motor which fits between the diver's calves and drives a propeller. It will sell for about \$200.



**Electric hot towel** gives a "sauna bath" to the face. Looking like a Halloween mask, the silk and satin device straps comfortably in place and plugs into a control console. Guests at the London Sauna where it is used usually keep it on for a period of about 20 minutes at a time.



**Lightweight diving helmet** combines best features of scuba gear with standard heavy diving equipment and can be worn with either. Made of glass fiber, it can be worn safely to extent of present decompression tables. It has adjustable suspension inside to fit diver's head and requires only one view plate. In standard helmet (top right), the diver twists head to peer through several openings.





TO TEST TRACTION of ceramic studs on ice, test vehicles were linked via 500-lb. scale drawbar. Under all

## Ceramic tire studs...

# They really grab you!

They claim to deliver extra winter go and whoa long after their metallic competitors have worn out. Here is the Popular Mechanics test answer

By ALEX MARKOVICH

**T**HE BARRIER still seemed far enough away—well over 40 feet—when the speedometer needle passed “10” and I kicked the brakes. But the wheels locked and the 1966 Chevrolet hardly slowed as it glided across the ice.

Wood and plate glass approached in slow motion as I waited helplessly. Finally, two feet short of a nasty jolt, the car stopped. I had needed all of 41 feet to stop from 11 mph.

I ran this test several more times, making sure to leave myself extra stopping distance; then I replaced the rear snow tires with a similar pair equipped with

ceramic studs. These studs—sharp, hard inserts projecting from the tire tread—were recently developed by the Coors Porcelain Co. of Golden, Colo.

I had been skeptical of ceramic studs, mainly because no one else was taking them seriously. Most automobile and tire companies had never heard of them. The National Safety Council found them less effective than tungsten carbide studs, but admitted that poor ice conditions prevented thorough testing. One major tire manufacturer concluded that they are “no better on ice than an unstudded snow tire.” My tests proved otherwise: Even





test conditions, ceramic studs outpulled other types

at speeds between 9 and 15 mph the ceramic studs stopped the car several feet sooner than did unstudded snow tires. In my tests, they even did better than tungsten carbide studs.

The scene of my testing was the huge ice rink at the Broadmoor Hotel in Colorado Springs, Colo. Piled in one corner of the rink were six "spare" wheels and tires, including two brand-new snow tires dotted with ceramic studs, two almost-new (400 miles of wear) snow tires with tungsten carbide studs, and two snow tires with ceramic studs that had run over 2100 miles. All were to be switched with the studless snow tires (75 miles of wear) already on the rear wheels.

Surprisingly, Coors doesn't claim their studs give better ice traction than do tungsten carbide studs (even though the Coors studs did better in my braking tests). Coors does claim, however, that their studs give at least as good traction, that they last longer, resist tearing out of the tread better, and run cooler.

**The most obvious difference** in the studs is their shape. The tungsten carbide stud consists of a steel jacket shaped like a stubby nail into which a tungsten carbide pin is inserted. The one-piece Coors ceramic stud resembles a golf tee, but is shorter and thicker. Both types are shot headfirst from a special air gun into holes



**CERAMIC STUD**, left, is of one-piece construction. Tungsten carbide stud consists of steel outer jacket and tungsten carbide pin. Ceramic stud resists heat



**STUDS ARE SPACED UNEVENLY** to eliminate resonance. Ceramic design protrudes less than other types, but Coors engineers claim tire traction is not affected





**STUD SCRATCHES** were easy to identify on smooth ice following braking tests. Studless snow tires tracked noticeable smears, made possible exact measurements



**SCALE WITH 500-LB. CAPACITY** hooked between test vehicles indicated tires equipped with ceramic studs would out-pull plain snow tires on ice

formed in the tread during the tire's manufacture. Nearly every snow tire today is "pinned," or provided with anywhere from 70 to 150 or more stud holes. A few manufacturers even pin conventional highway tires.

The trouble with tungsten carbide studs, say Coors engineers, is that they tend to twist, tip over and rip out during hard service because the tread rubber doesn't fit as snugly around their nailheads. Also, since the ceramic studs are lighter, there is less centrifugal force pulling the studs out at high speeds, says Coors.

Tungsten carbide studs suffer from still more problems. The tungsten carbide pin can slip out of the steel jacket or simply wear away, leaving the stud useless. But the one-piece ceramic stud is at least partly effective as long as any part of it remains.

At high speed or during cornering, tungsten carbide-stud jacket temperature can exceed 300° F., and the tips have been known to reach 1500°. Heat tends to enlarge the hole around the stud. Occasionally, on metal-studded tires that have been driven hard, the rubber melts and chars around the studs. Since ceramic materials are poor heat conductors, Coors says its studs eliminate this problem.

Another problem that still hasn't been licked is loss of efficiency due to wear. The National Safety Council found that tungsten carbide studs are practically useless after 5000 miles due to wear and "fall-out." Coors expects ceramic studs to provide several thousand useful extra miles. But in my tests, even the 2100-mile-old ceramic studs stopped far less efficiently than did new ones.

Besides braking tests, I ran drawbar-pull tests in which the Chevrolet was tied in front of a Jeep with a 500-pound scale in between. In the static tests, with the Chevrolet pulling away from a dead stop



**GUIDING "FINGERS"** of air gun spread open hole in rubber tread, fire ceramic stud headfirst into tire



and the Jeep's brakes locked, I averaged over 408 pounds of pull with unstudded snow tires, 460 pounds with new ceramic studs. Somehow, the older ceramic studs managed an average of over 487 pounds (possibly because the ice was roughed up from previous tests, or because the tires "froze in" after standing for a while).

In the dynamic tests the Jeep was towed slowly with brakes disengaged and the transmission in neutral. Then the driver of the Jeep gradually applied the brakes until the Chevrolet lost traction. Here the snow tires averaged 270 pounds of pull, the used ceramic studs 450 pounds, and the new ceramic studs pulled over 500 pounds every time.

Even more impressive was the way the studs—both ceramic and tungsten carbide—felt. The car got up to speed faster, wheel spin was less of a problem and cornering was greatly improved.

**Studs aren't new.** The first ones for passenger-car use were introduced in Finland just after World War II, and racing and rally drivers experimented with primitive versions years before that. This year 600 million studs of all types are expected to be sold in this country.

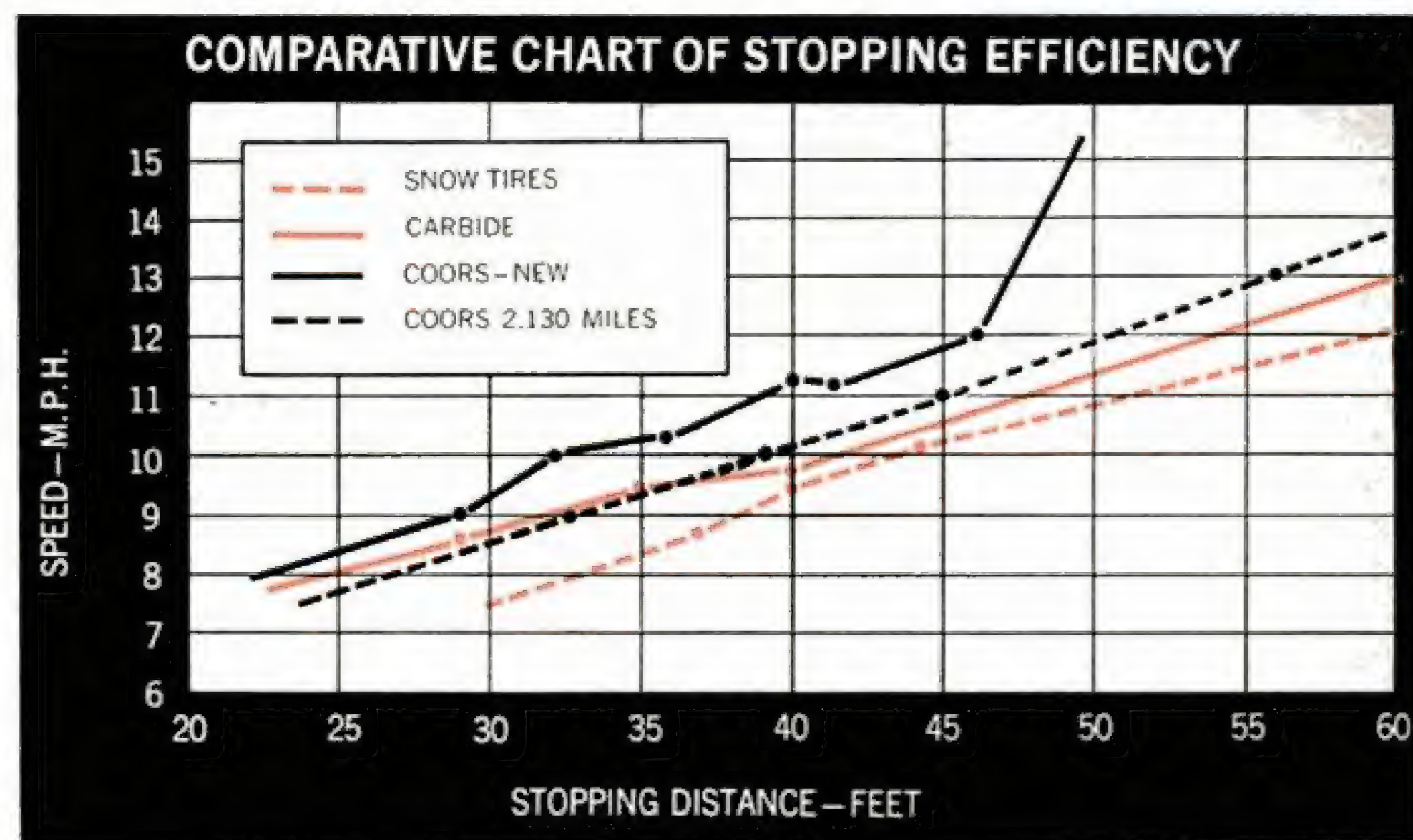
A few years ago most states had laws against tire projections of any kind—aimed mostly at cleated farm and con-

struction vehicles that caused severe road damage. But recent tests have proved road damage from studs is negligible. Since, many states have revised their laws.

**Machine is kept under wraps.** Coors forms its ceramic studs in a special machine that splits them out one by one, like pills. Unlike tungsten carbide, which is relatively scarce and expensive, ceramic materials are abundantly available and much cheaper. Ceramic studs are made primarily of aluminum oxide and, when first formed, are soft and brittle. Then they are hardened in a 3200° F. oven.

The cost of applying ceramic and tungsten carbide studs is comparable—about \$6 to \$10 a tire—but increased production of ceramic studs is expected to bring their price down. This will make it easier, Coors hopes, for motorists to buy studded tires for all four wheels. Since the front wheels carry about 60 percent of the braking load, studded tires front and rear would have made my braking tests that much more impressive.

This year Coors plans to sell its studs only in Colorado, Wyoming, Utah, North Dakota, South Dakota, Nebraska, upper New York, western Pennsylvania, Michigan, Wisconsin, Minnesota, Idaho and Montana. A year later Coors says they should be available nationwide. ★ ★ ★



**STOPPING DISTANCES** for new and worn ceramic and tungsten carbide studs indicate loss of efficiency after comparatively limited use, a problem with any type of stud. Test speeds ranged from 9 to 15 mph



# BUILD A TABLETOP PRINTING PRESS

An ideal project for any hobby center or school shop, this small press does a top-quality job of reproducing type, linoleum blocks, woodcuts, etchings and, with a special cylinder, even lithographs

By **MANLY BANISTER**  
Drawings by Aubrey Kochman

## Part 1



**CENTER PIPE CORE** for the blanket cylinder is adjusted concentric with the end plates. Then the nuts are tightened on the threaded rod to hold the plates firmly in position while the pipe is welded to them

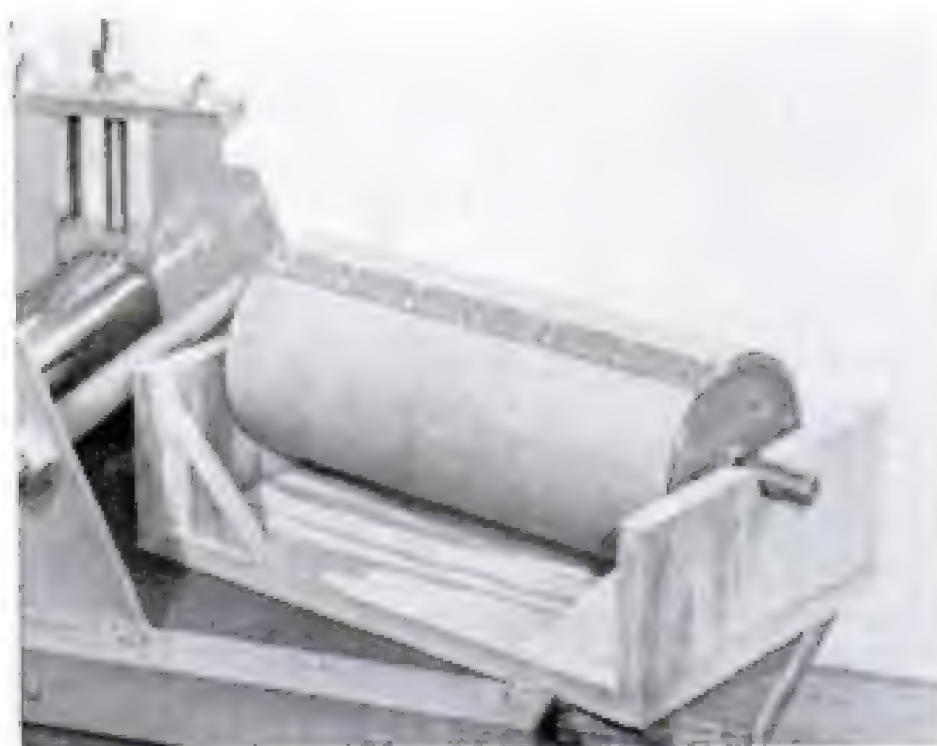
**H**AND-WORKED BLOCKS and plates for printing are enjoying wide popularity today, and although it's possible to work a plate and then have it printed professionally, almost all artists prefer to print their own. This way they have complete control of every step of the printmaking operation.

Here's a press that will not only handle printmaking but many other types of printing. With it, you can print from forms made up of handset type or Linotype, from linoleum and wood blocks, from etchings and engravings, as well as from halftone plates. And it can be built in any modestly equipped shop for less than one-fourth the cost of a commercial model of the same capacity.

By replacing the steel roller on top with a cylinder covered with a rubber



**TO CHECK ROLLER DIAMETER** mount dial indicator on the carriage and run it along the roller with the button riding the center line. If needle varies no more than a thousandth or two, it's within tolerance



**BLANKET CYLINDER** shouldn't be allowed to rest on the rubber blanket, so you'll have to make up a special storage cradle from scrap plywood to hold the cylinder when it's not being used on the press





**FIRST IMPRESSION** of woodcut (see inset) is a quality check to determine final adjustments for the press

blanket, the press is set up for offset lithography from a lithographic stone as well as from zinc and aluminum plates which are standard in the printing trade. You even have a choice of hand or motorized operation.

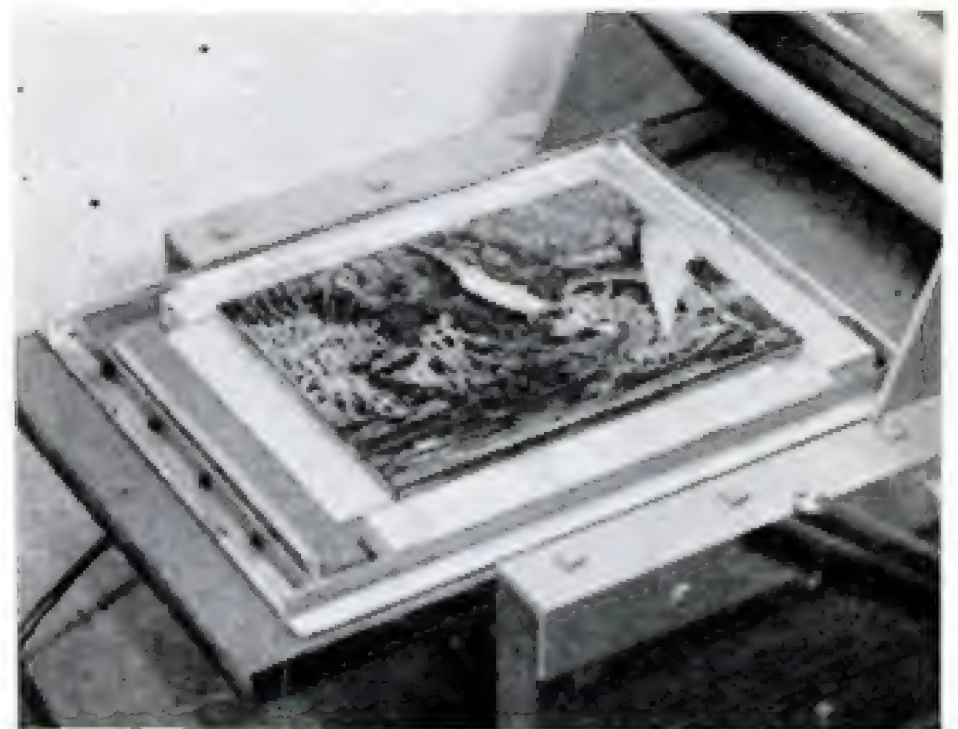
In order to insure top quality of the prints it turns out, the press must be of heavy construction throughout. The model shown weighs about 150 lbs., including the top roller and bed. A further advantage of this design is that the builder can scale the dimensions up or down to produce a press of greater or lesser capacity to suit his own needs or his workshop equipment.

With the standard bed, the press will print any block up to nearly 14 in. wide and 24 in. long. However, a bed of any greater length can be substituted for printing streamers or banners of any length desired. The size limits for lithographs are restricted by the dimensions of the rubber blanket (approximately 14 x 16 in.).

Standard gears are used in the gear train, and these, plus the four bronze

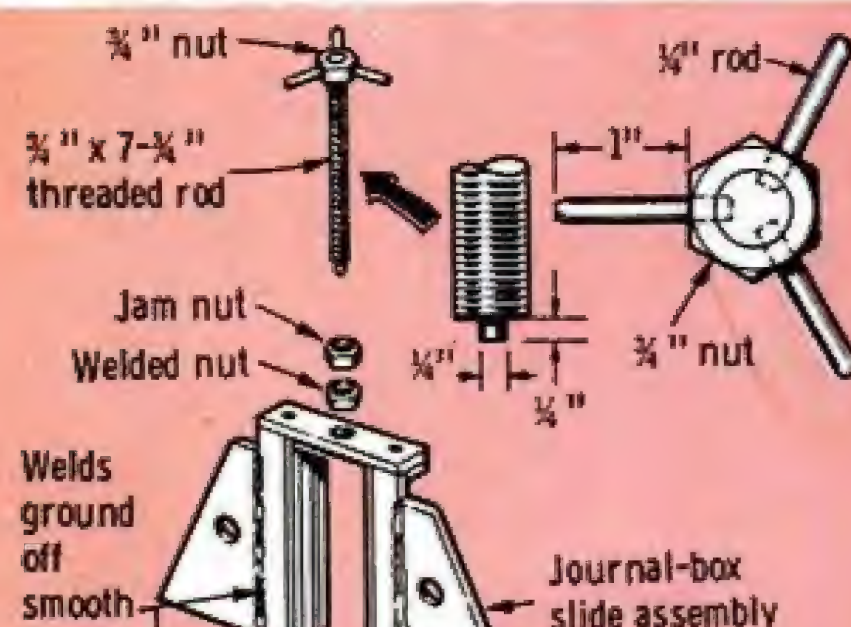
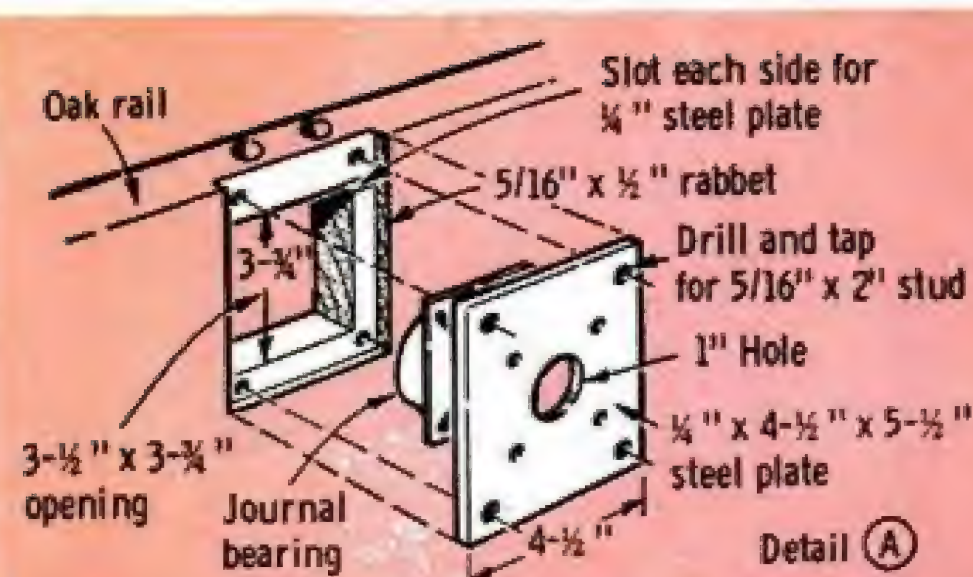
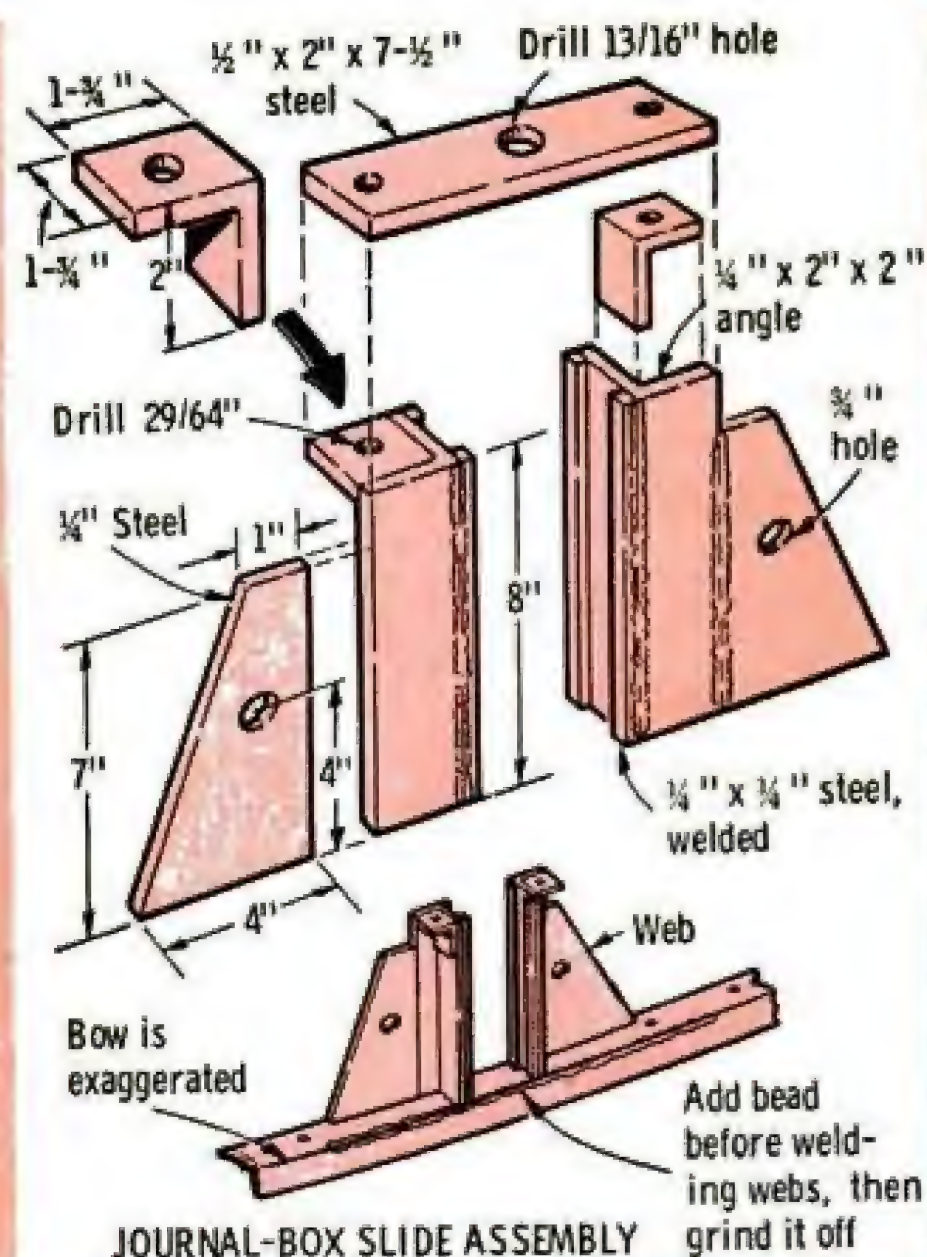
bushings, can be ordered from the Boston Gear Co. for \$20.90. A reduction ratio of 1:8 is provided, making hand operation extremely easy, and as little as 1/20 hp in a gear-reduction motor can be utilized for motorized operation.

A good place to begin construction is with the rollers. A metal-turning lathe with a 6-in. swing will do all the work re-



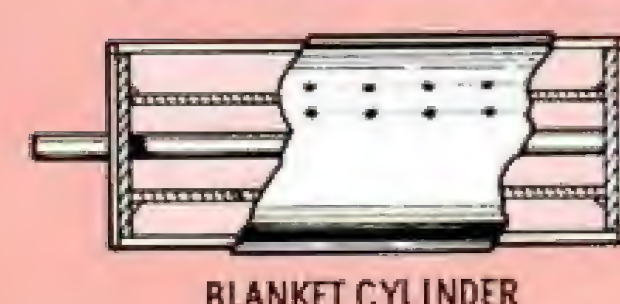
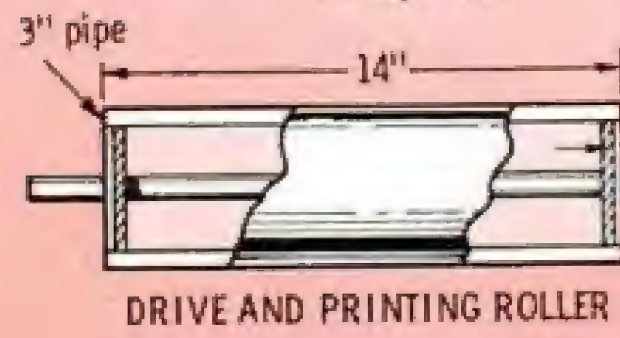
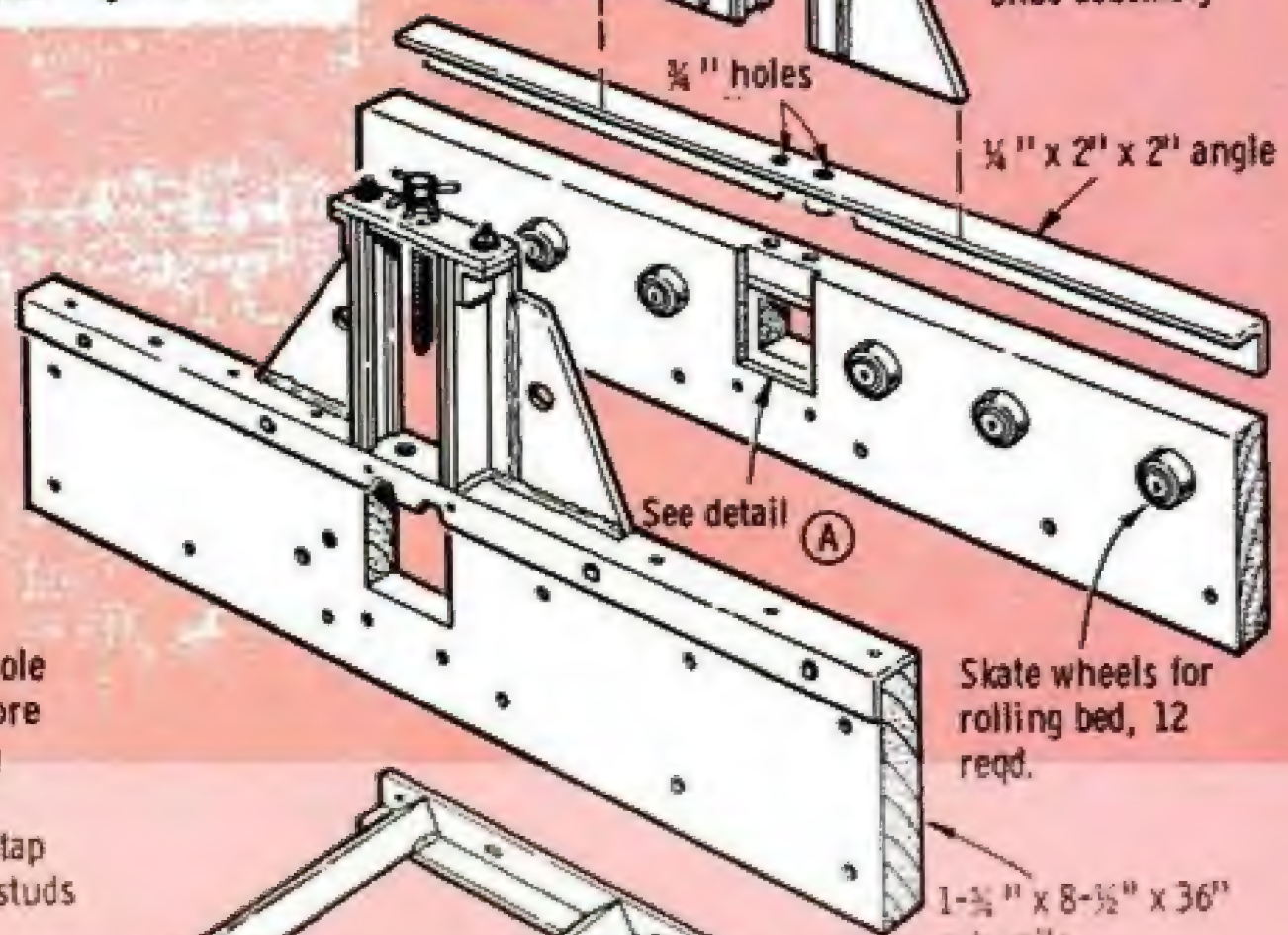
**READY TO PRINT**, the block is locked up in the chase with "furniture" (wood blocks) around it. Construction of the chase, bed and other parts of the press will be covered in Part II of this article next month



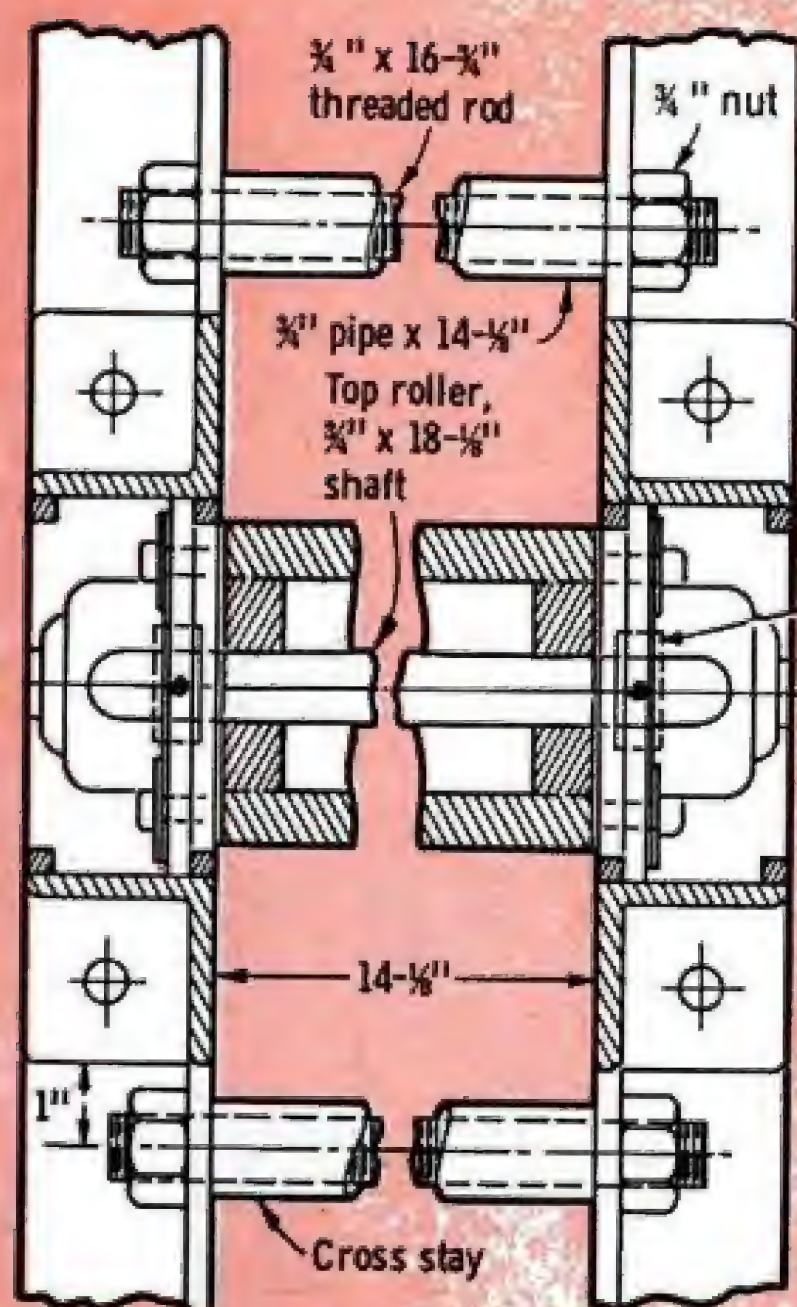
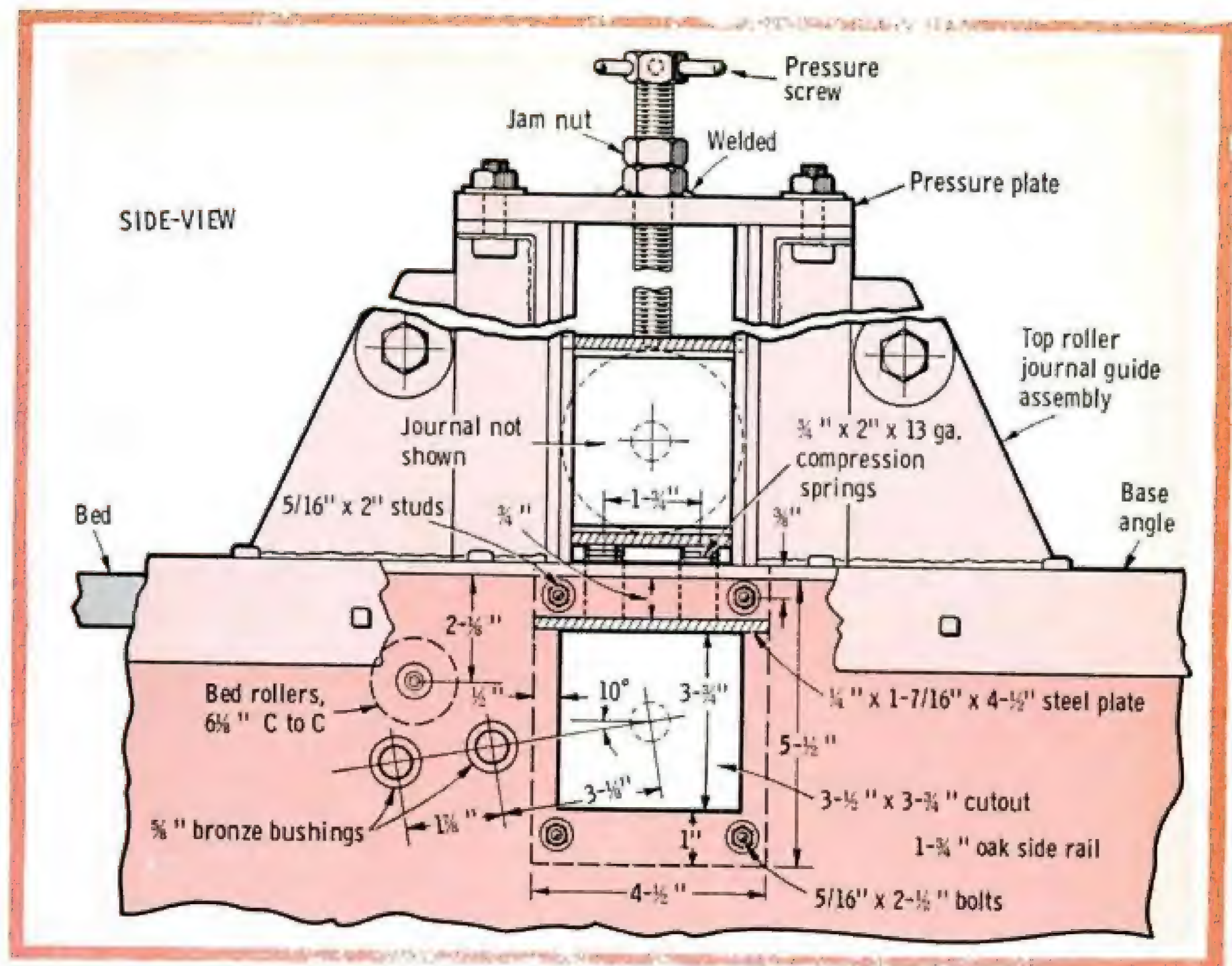


**CUT FOLD TAPE**

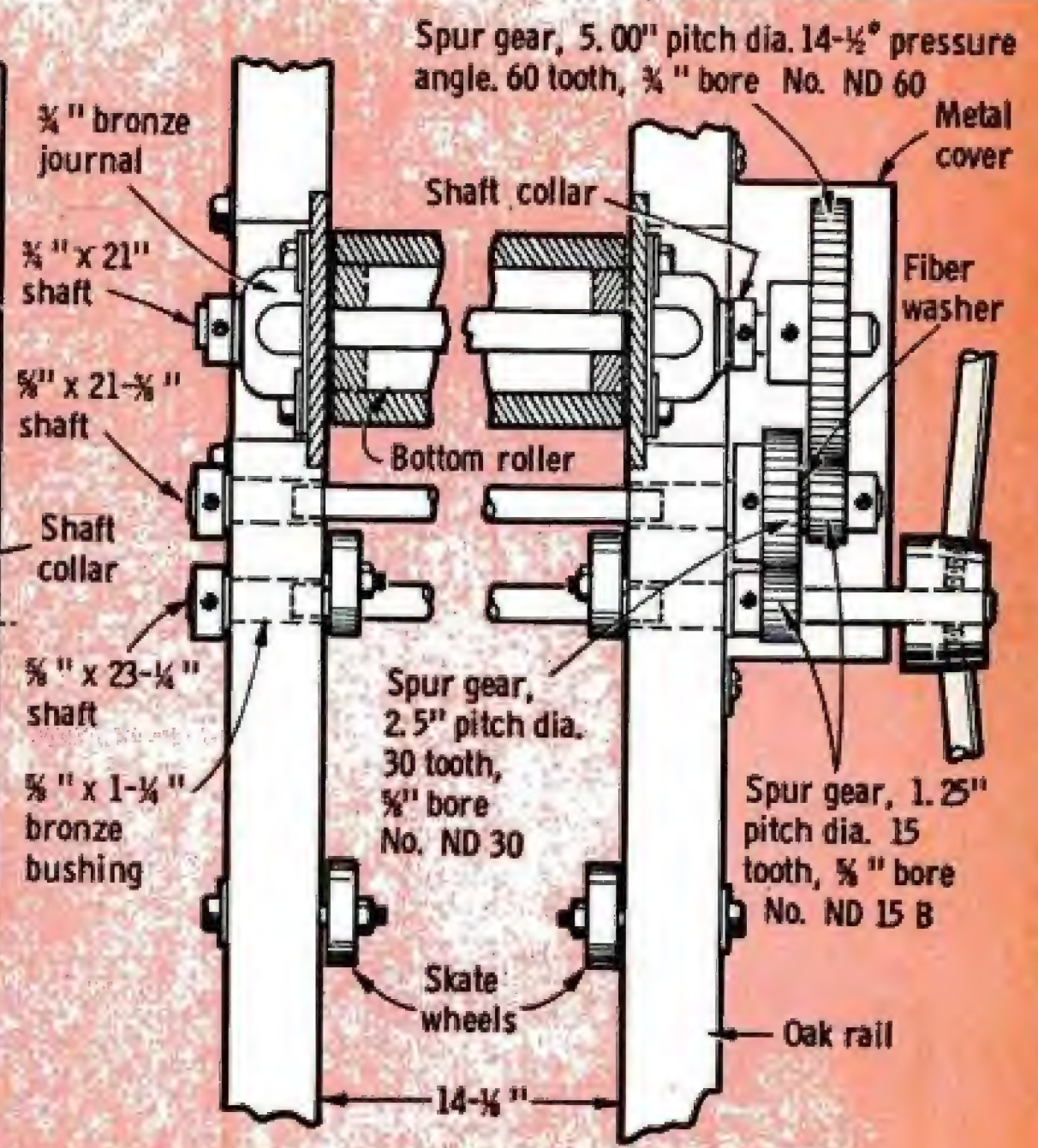
**PRINTING PRESS**







**TOP VIEW  
TOP ROLLER IN PARTIAL SECTION**



**TOP VIEW THROUGH BOTTOM ROLLER**





**SIMPLEST METHOD** of cutting the rabbets for the journal plates is to use a router with guides clamped to the plank. If you don't have access to a router, the job can also be done with a wood chisel



**BEFORE DRILLING** holes for the bed-roller bolts, double check the location by lifting the drive roller as high as it will go in the journals and measuring with a square. Add bed-roller radius to this figure

quired on the rollers except turning down the blanket cylinder. After I had welded up the rough cylinder, I had it turned at a machine shop for \$8.50, then mounted it between centers in my 6-in. lathe and finished up the surface with file and emery cloth.

The drive roller and steel printing roller are made of standard 3-in. pipe—double-thickness wall ( $\frac{5}{8}$  in.) if it is to be had, though single thickness would do. The nominal o.d. of 3-in. pipe is  $3\frac{1}{2}$  in., and most of this is retained in the turning. Final diameter can be anything between  $3\frac{1}{4}$  in. and  $3\frac{3}{8}$  in. You can use

standard-thickness 5-in. pipe to keep the weight within reason. The nominal o.d. is  $5\frac{1}{2}$  in. and you should have at least  $5\frac{1}{4}$  in. left after turning.

The best way to make the end plates for the 3-in.-plus rollers is to saw them oversize from  $\frac{1}{4}$ -in. steel plate on a metalcutting bandsaw. Drill a  $\frac{3}{8}$ -in. hole through the center of each, then stack them on a  $\frac{3}{8}$ -in. bolt that has its head drilled to receive the lathe tail center. Run down the nut on a lock washer, then grip the nut in the lathe chuck and bring up the tail center. Machine the o.d. of the

*(Please turn to page 238)*



**WHEN DRILLING** center holes of the journal plates on the drill press (left), clamp the work to the table, backing it up with a piece of plywood to take the point of the drill bit. Journal plates can be clamped together and drilled at one time. Use a metal cutting bandsaw to cut the journal bases down to the required  $3\frac{1}{4}$ -in. square. A piece of steel or wood clamped to the table makes a good fence to assure accuracy of cut. First cut  $\frac{1}{4}$  in. off each of two adjacent sides, then reset the fence to trim  $\frac{1}{4}$  in. off the two remaining sides. If a metal cutting bandsaw isn't available, the job can also be done by hand, provided you take pains to cut accurately





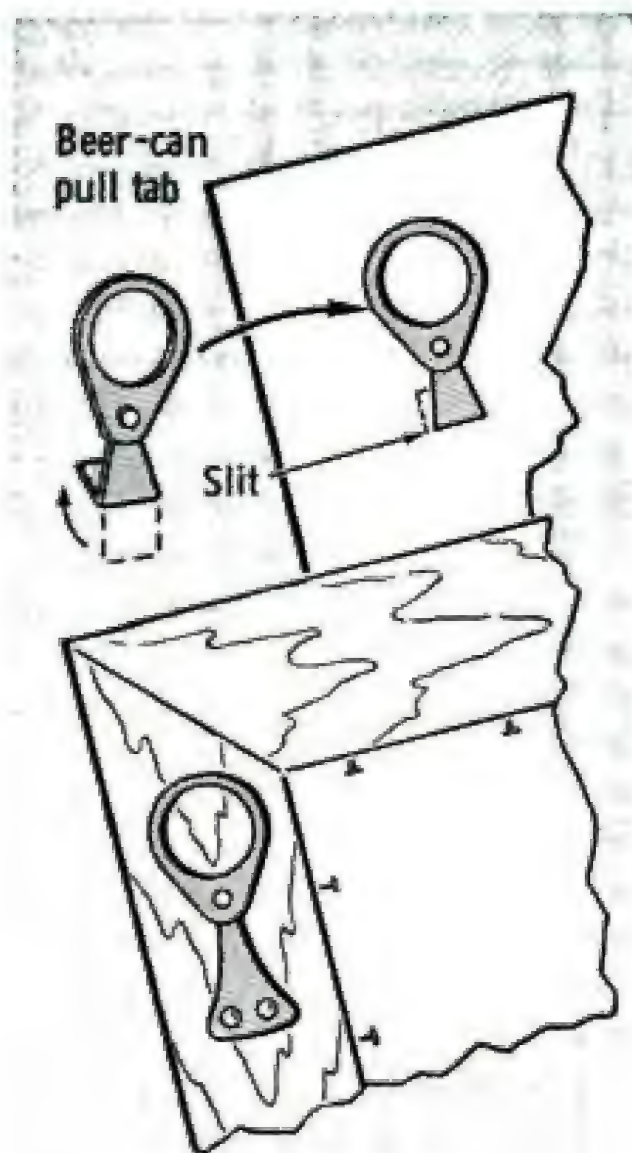
# Solving home problems



**COCKTAIL BELL** for the rec room is made by cutting the base off a wine glass. Fishline-sinker clapper hangs from screw eye set in small piece of wood cemented in glass

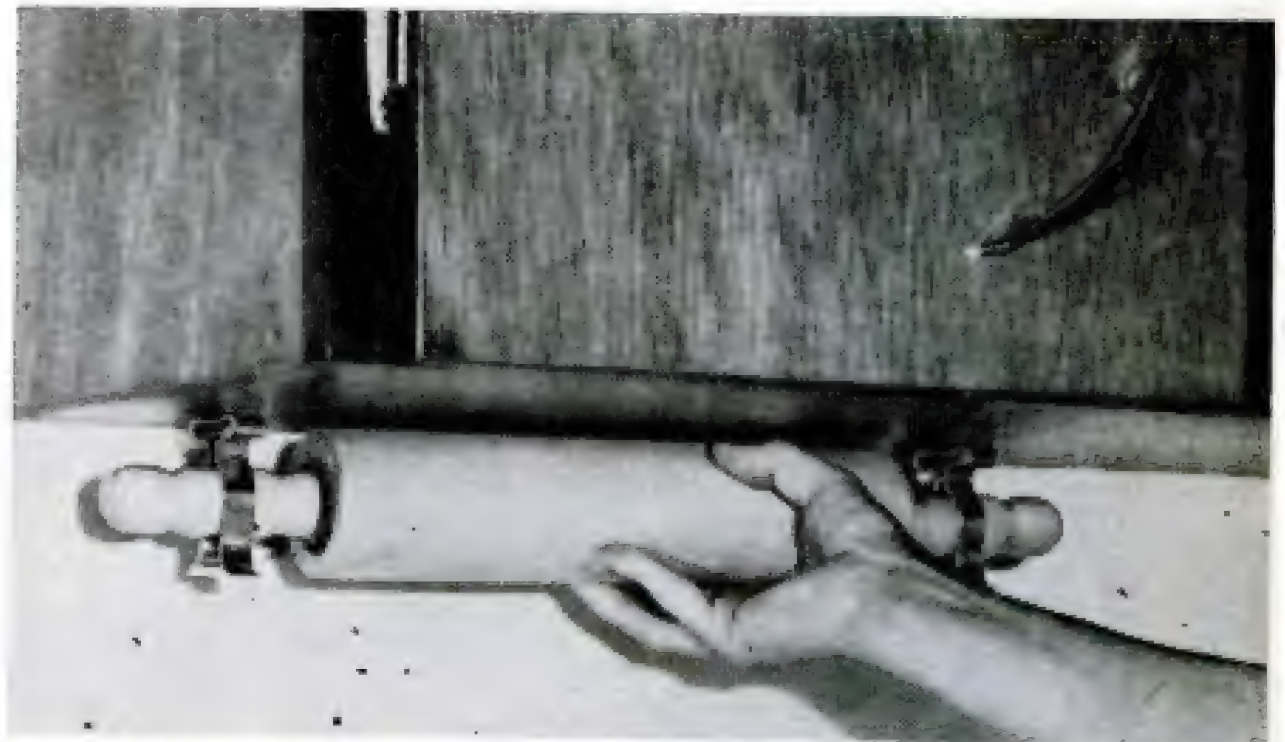


**DON'T RUIN A GOOD BRUSH** trying to paint those hard-to-reach spots on a radiator. A discarded bottle brush will handle the job easily

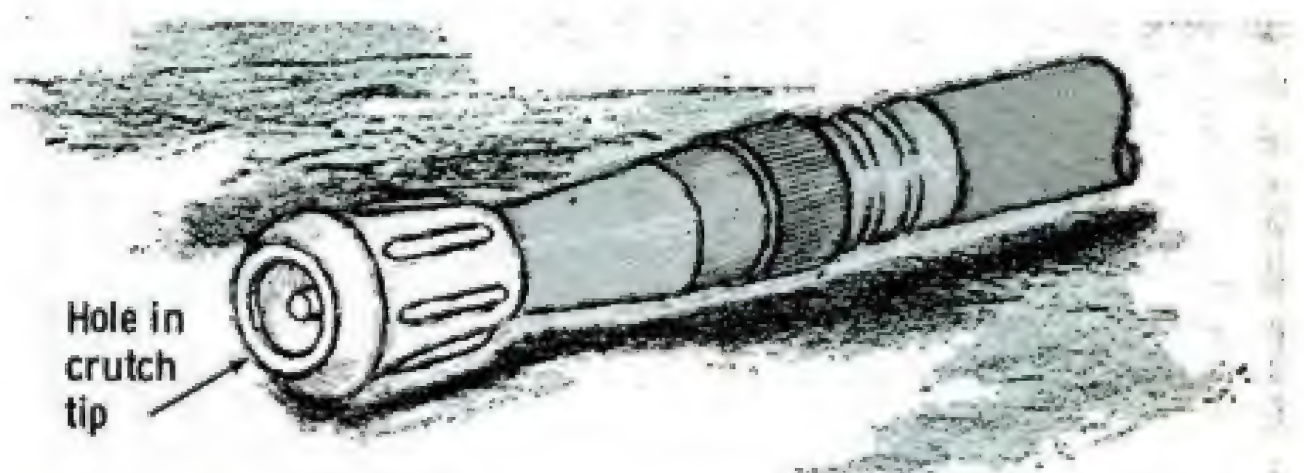


**PULL TABS** from pop-top beverage cans make excellent picture hangers. With small pictures you can simply slit backing board to hold a tab. Otherwise, nail to frame

NOVEMBER 1966



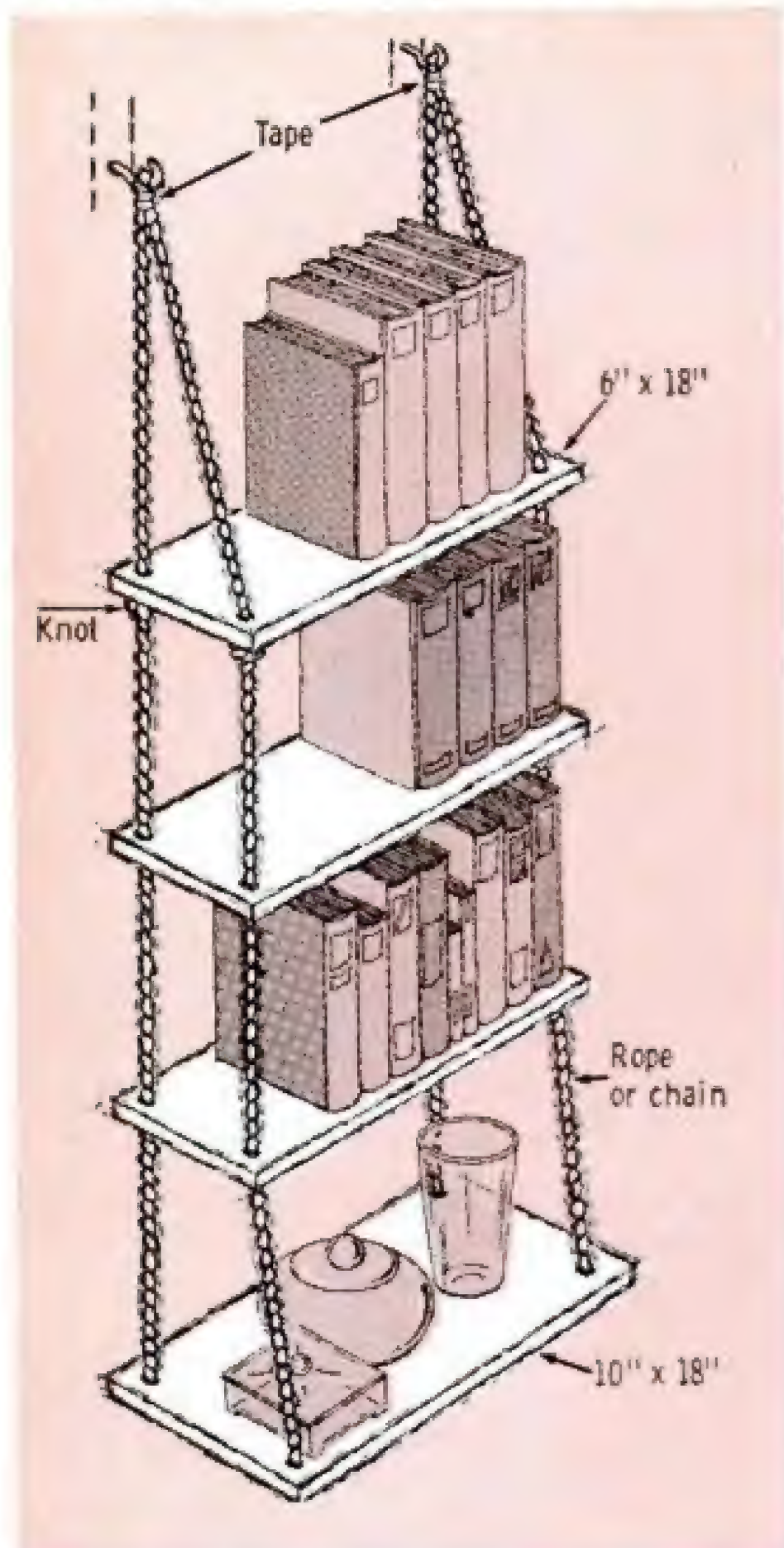
**ROLLING-PIN RACK** mounted underneath a hanging cupboard handy to the baking area can save steps and time. It's a pair of broom clips



**YOU WON'T SCRATCH YOUR CAR** with the hose nozzle if you cut a  $\frac{5}{8}$ -in. hole in the end of a rubber crutch tip and slip it on the nozzle



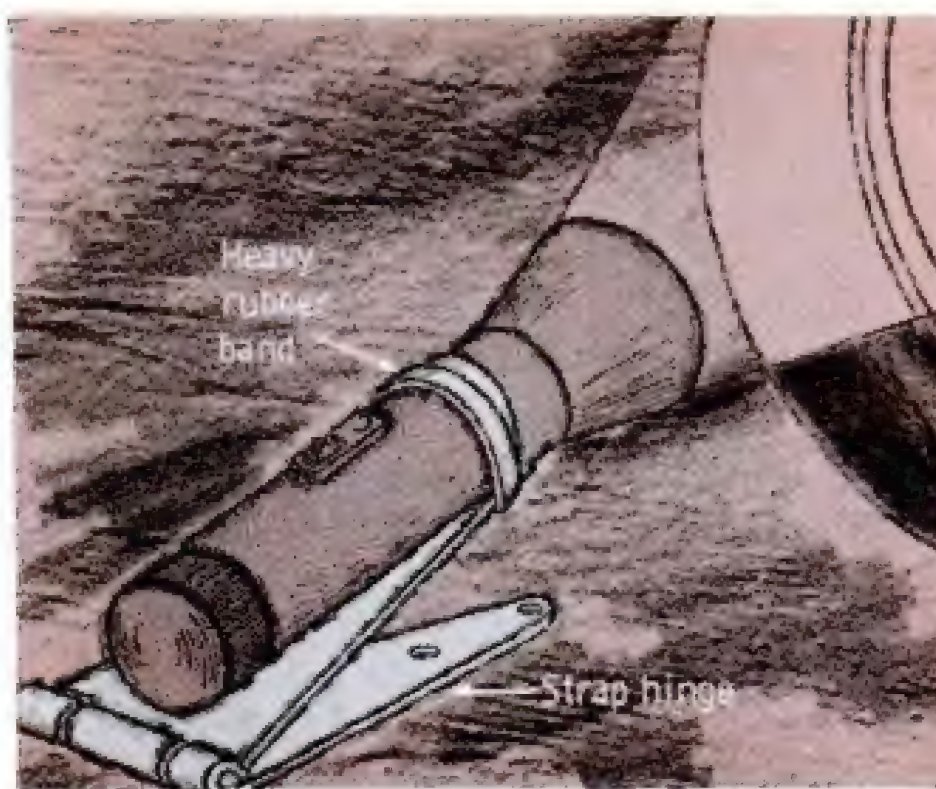
# Solving home problems



**HANGING BOOKSHELVES** made from a couple of lengths of rope and some boards are suspended from large screw hooks driven into studs. The shelf spacing is controlled by location of supporting knots



**TO PROTECT CLOTHES** hung on coat hooks, cut a small slit in a sponge-rubber ball and press this over the hook. The ball provides a larger surface to support garment, thus avoiding unsightly hook bulge



**FLASHLIGHT STAND** made from a strap hinge holds the light where you want it while leaving both hands free to work. Hammer hinge joint until it holds position as adjusted. Mount light with rubber band



**NOVEL TRIVET** for holding hot dishes or flower pots can be assembled from a molded-fiber egg carton and a tray of similar material and size (such as used in packing meat). Decorate with bright spray lacquer

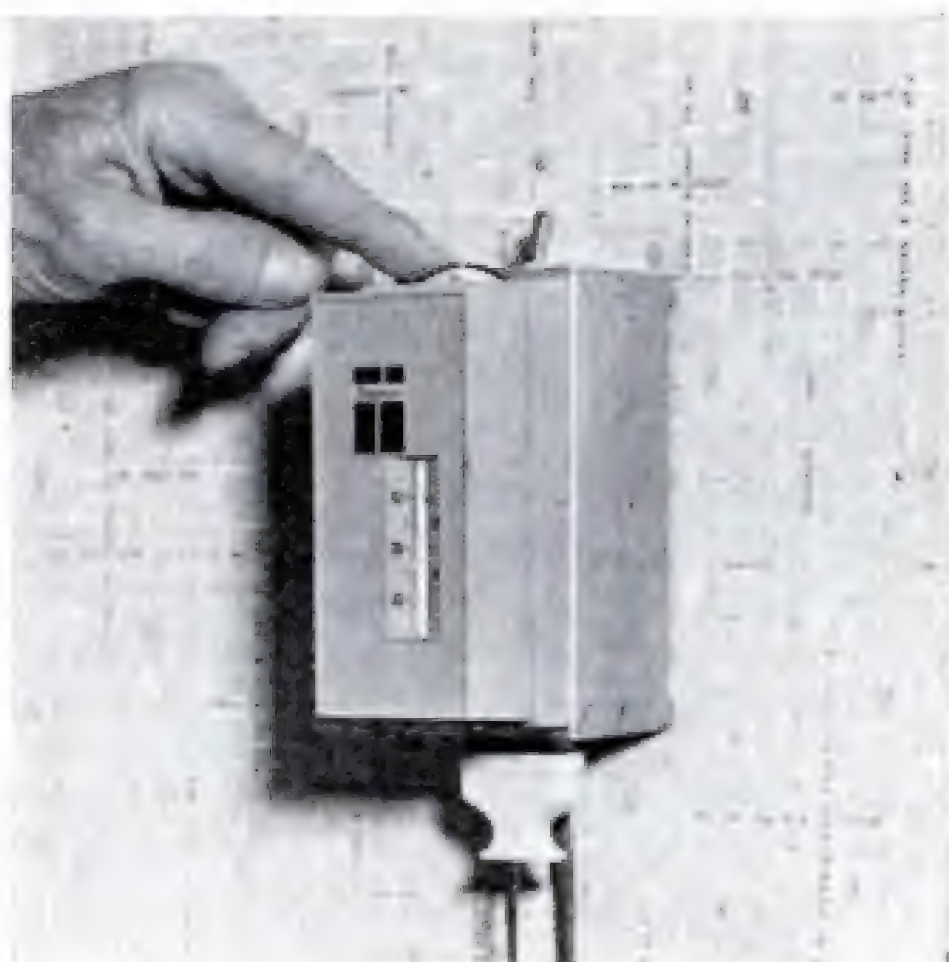




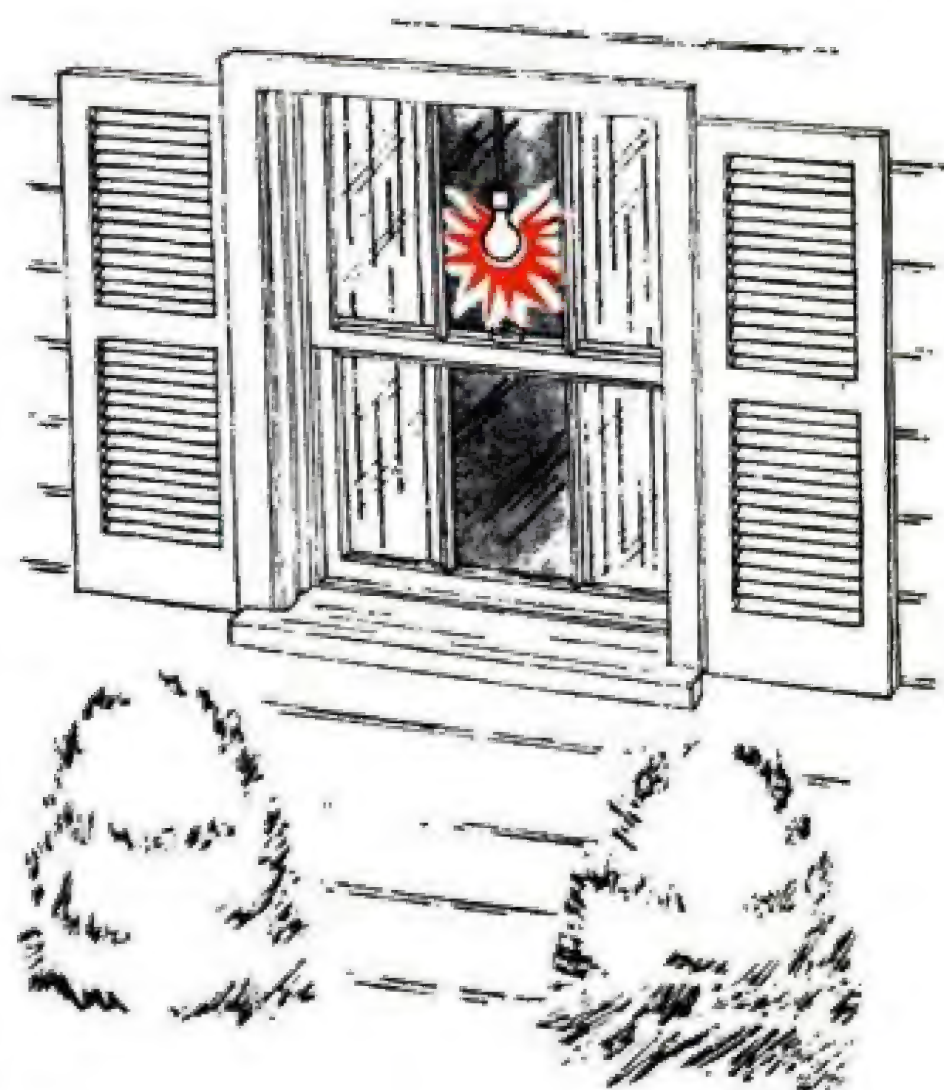
# Temperature Sentry

## GUARDS AGAINST FREEZE-UP

By Harold P. Strand

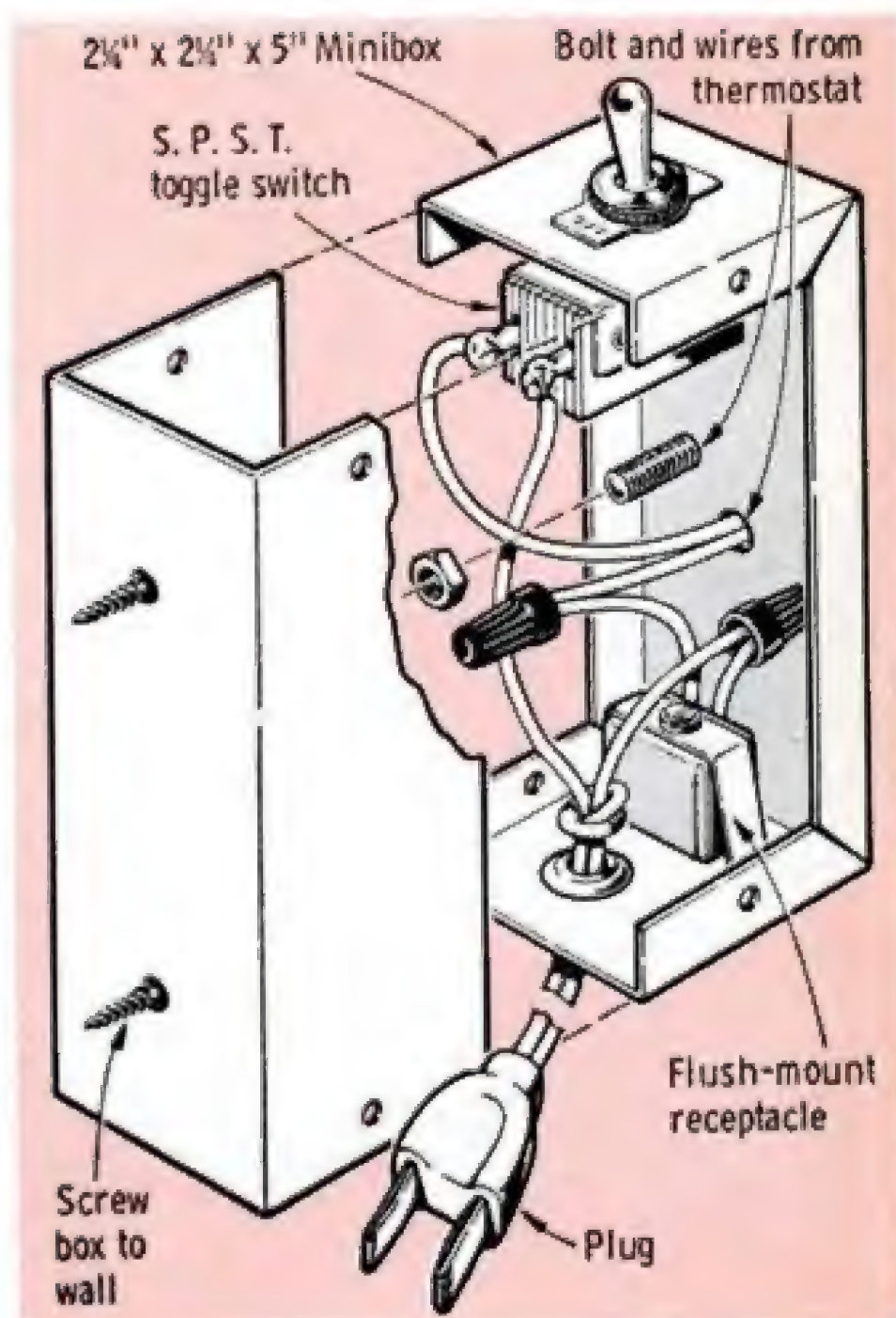


**MOUNT UNIT** on inside wall about 54 in. off floor where there's good air circulation, and nearby outlet to plug it into. Extension cord then plugs into it



**ON GUARD** during your absence over a winter weekend or vacation, this device could save your home from burst water pipes and other freeze-damage. Sure, you left your thermostat set low to keep enough heat in the house to prevent such accidents—but what if the furnace fails to go on under automatic control some night when the mercury's huddled in the bulb? Maybe there's been a mechanical or electrical failure. It happens—many a homeowner has had his Florida tan turn white over the major plumbing repairs that faced him on his return from winter vacation.

Here's how the sentry works. It has its own thermostat, which you set about 10° lower than the thermostat for the furnace. Should the temperature fall below the setting on the latter without the furnace coming on, the house will continue to get colder until the sentry's thermostat triggers a warning. The warning can simply be a 40-watt bulb, connected to the sentry by an extension cord and hung in a window. A neighbor, who's been alerted to watch for it, will know that







**COVER OFF** to show how thermal switch works: Silvered contacts close when temperature drops to dial setting, activating plugged-in lamp or buzzer



**COMPLETE SYSTEM**, ready to install. If naked socket, hung in window from its cord, is objectionable, plug a table or floor lamp into sentry, instead

something's wrong with the heating system when he sees the lighted bulb, and can phone for service. (You'll have left an emergency key with this neighbor to let the service man in.)

But you needn't go away to make use of this handy device. The sentry can be kept on duty all winter long and save you from awakening to a frigid house, in case your automatic system konks out while you're asleep. For this purpose, you hook the sentry up to a 115-volt buzzer, placed near your bed. Set your regular thermostat as usual—say, 65-70. Set the sentry's at 60. If the temperature drops that low during the night, the buzzer wakes you so you can find out what's gone wrong.

The parts shouldn't cost you over \$15—much less if you already have a spare

line voltage thermostat on hand. Buy or make an aluminum box and mount a toggle switch and any type flush receptacle in it, as sketched on the previous page. Solderless wire nuts are shown on the two splices of the No. 18 wires, but solder is required at the switch terminals. Leads are carried through a small hole bored in the box to reach the terminals at the back of the thermostat, then the latter is bolted to the face of the box. Secure the box cover to the wall with screws or hollow wall fasteners before final assembly.

Now, as you leave on your trip, set your regular thermostat around 58-60° and set the sentry's thermostat at, say, 50°—and depart with confidence. Your only concern as you travel should be finding an appropriate gift to bring back to your accommodating neighbor. ★★★

## Protective railing keeps tots from tumbling



**OPEN STAIRWAYS** can be a hazard if you have toddlers in your home. Most dangerous of all are those stairs to the basement which are commonly provided with only a handrail. Since such rails are located for adult gripping, youngsters can't reach them, and tumbles result.

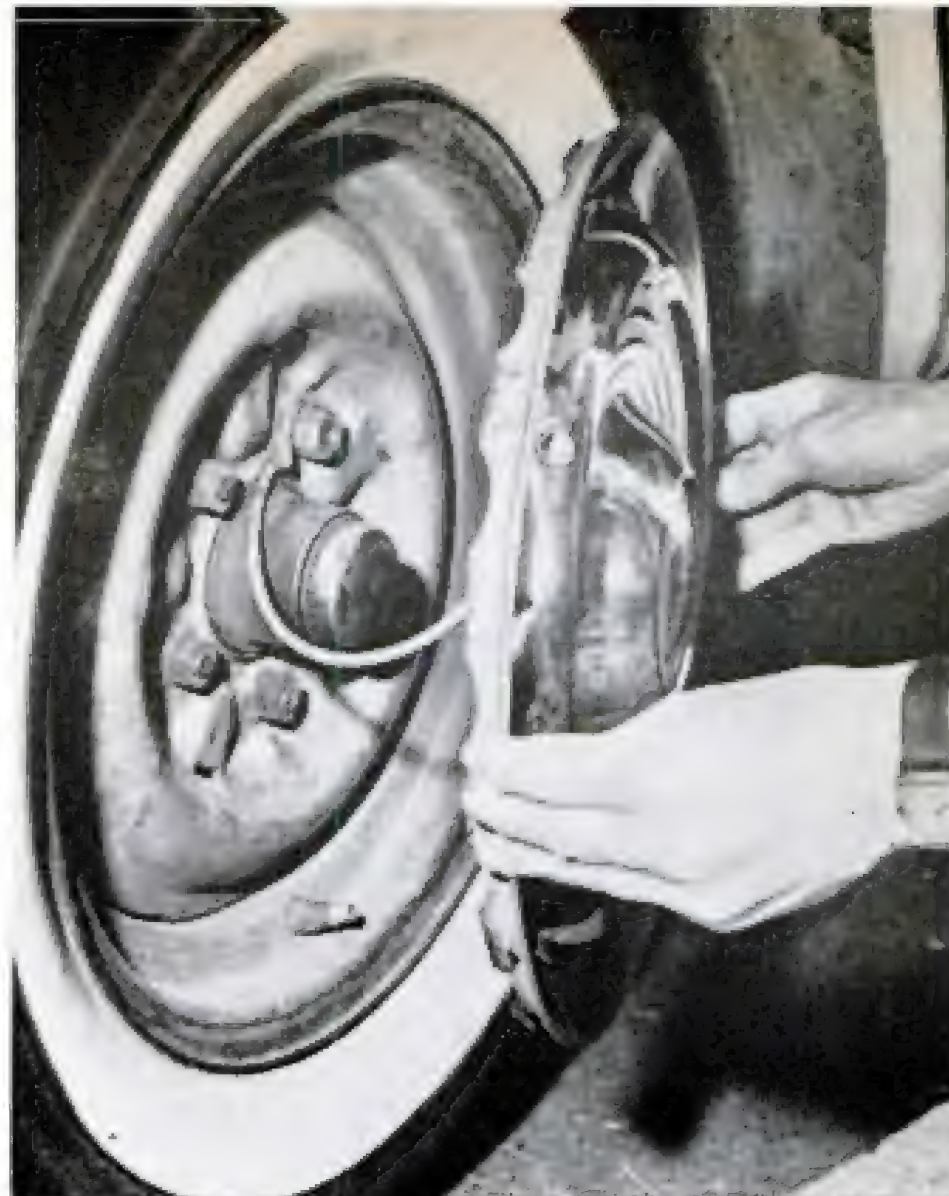
All this is prevented if you string plastic clothesline between the treads and the rail as shown. Just drive a large screw-eye into the center of each tread and run a line of eyes, spaced to match, up the underside of the rail—and along a ceiling cleat, if the rail butts the ceiling. Now thread one length of cord up and down between every other eye, and a second length between the eyes you've skipped, keeping both taut.—Mary Zook



## Make hub caps theft proof

If your hub caps were among the 3 million stolen last year, you're ready to grab onto any system to forestall their loss again. Valve-stem locks are ineffective and, worse yet, have led the thieves to yank out the entire valve stem.

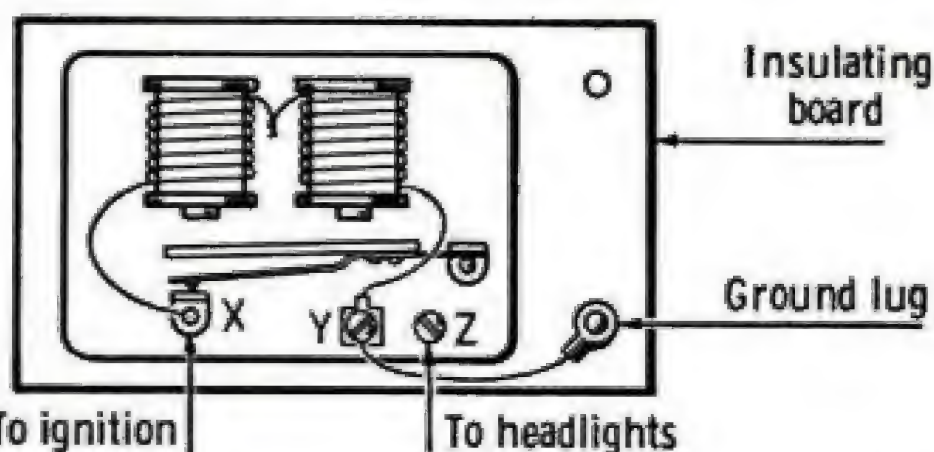
Better protection is afforded by using a plastic-sheathed 18-in. stranded steel wire attached to the hubcap and the wheel. Splice and solder loops at the ends.  $\frac{3}{16}$  in. at the hub cap and  $\frac{1}{2}$  in. at the wheel. Behind the valve-stem hole, drill a  $\frac{3}{16}$ -in. hole for a chromed license-plate bolt. Secure it with a lockwasher and nut over the cable and fill the bolt slot with solder. Slip the other end of the cable over the wheel stud furthest from the valve and turn on the nut. Now, only a determined thief with a lug wrench will make off with it.—*John Wilson*



## Alarm sounds off as reminder to douse headlights

At dusk and at dawn and in well-lighted parking lots, many of us are prone to forget about turning off headlights. Here's an alarm that won't let you forget.

Mount a 6-v. buzzer on a piece of plywood to insulate its case from the car's chassis. The grounded screw, Z, for the movable contact is hooked to the headlight switch. The insulated terminal screw, Y, from one side of the coil is attached to a 10-ohm, 10-watt resistor and then under a mounting screw to chassis ground. The resistor drops the car's voltage. The wire from the other side of the coil to



the stationary contact must be provided with a terminal, X. The lead from here is attached to the ignition coil.

With the ignition on, the coil acts as a relay; with it off and the headlights on, it's again a buzzer.—*Virgil Parker*

## Belt the oil filter

Banged knuckles or a dented reservoir are often the only rewards for trying to change your car's oil filter. As a solution, you can try the following approach.

Clean the oil off the reservoir exterior and buckle on an old leather belt. Punch a hole the diameter of a hefty screwdriver shank through the free end of the belt about an inch from the buckle. Insert the screwdriver down through the hole so that when pressure is applied to the handle, the belt tightens around the filter reservoir. This will give you the leverage needed.—*Louis Hathaway*





# The RIGHT Way to Store Your Outboard

By Henry B. Notrom

Illustration by Roger Chapin

**An hour or so and a couple of dollars—that's all it takes to prepare your motor for off-season storage. And it's the best insurance you can buy against a big repair bill next spring.**

**W**HY NOT SET ASIDE this Saturday morning to polish off the boating season in the right way—by getting your outboard set for winter storage. Winterizing a motor isn't a hard job or an expensive one, but believe, me, it's an important one.

Don't confuse winterization with tune-up. Checking points, plugs, fuel system, and replacing parts should be done according to the schedule in your owner's manual. If necessary, you can let that go until spring. The engine doesn't have to be tuned up as long as it isn't being operated.

Of course the easiest solution is to sim-

ply turn your engine over to an outboard dealer or marina for winter storage. The charge for winterizing and storage will depend on the size of your engine.

For example, in my area dealers charge around \$10 to winterize and store a 5½-hp engine. The same service costs about \$15 for an 18-hp motor and \$25 for a 40-hp motor. Personally, I'd recommend storing any engine above 40 hp with a dealer. Anything that large is generally too cumbersome to store around the house. Here, they charge an average of \$40 for a 75-hp motor, and I think it's a good value.

Dealers will also store batteries and





fuel tanks. Shops around here will clean, charge and store a battery for \$1.50 extra. Another \$1.50 will take care of cleaning, oiling and storing the fuel tank.

You can probably store the engine on the boat, if you normally put your boat in a marina during the winter months. For this sort of package deal, the marinas I checked will charge an average of \$1.50 per foot for the boat, plus the normal cost of winterizing and storing the motor as described above.

Now, if you're going to do your own winterization, approach it as an extension of normal service. That way you're less likely to put it off.

With the rig still in the water, put the engine in neutral, remove the cowling, start the motor and let it warm up.

Kiekhaefer recommends that a shot of storage seal (such as Quicksilver Storage Seal) be injected into the carburetor air intake while the engine is running. This method, the company states, distributes the seal throughout the crankcase and will protect the cylinders from rust and corrosion.

Johnson and Evinrude recommend that a special engine cleaner (such as OMC Engine Cleaner) be applied into the carburetor air intake to help remove carbon, gum and varnish. However, the engine should be run long enough for all the cleaner to be used up. That usually takes about 10 minutes.

"The cleaner itself," the company emphasizes, "can cause corrosion if left in the engine."

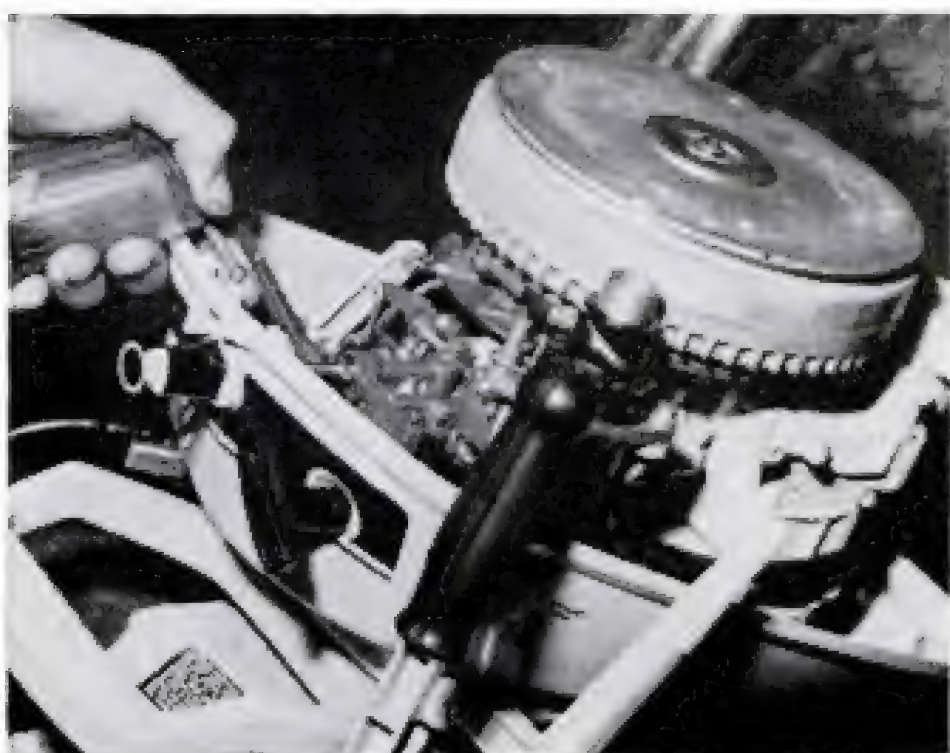
To my way of thinking, a combination of these two methods is the most effective, since the engine cleaner will get rid

## IF YOU RUN YOUR OUTBOARD IN THE WINTER

- ☐ Drain, flush and refill gearcase with recommended lube.
- ☐ Clean fuel filter bowl.
- ☐ Clean and regap, or replace spark-plugs.
- ☐ Lube all grease fittings.
- ☐ Check function of remote control unit.
- ☐ Check steering controls and lube.
- ☐ Lube carburetor and magneto linkages.
- ☐ Adjust tension of magneto or generator drive belt.
- ☐ Clean battery; coat terminals with petroleum jelly; make sure battery is fully charged.
- ☐ Check water pump and thermostat operation.
- ☐ Check ignition timing and condition of breaker points.
- ☐ Check carburetor adjustment.
- ☐ Make sure drain holes are clean and open.

## OPERATIONAL TIPS

- If controls freeze and become hard to activate, use a little penetrating oil on cable ends to free them.
- Maintain correct, recommended fuel ratio.
- When you put your engine into water, allow several minutes before starting.
- Keep lower unit in water at all times when you're on the water, even when engine isn't running.
- At the end of a day, take engine from water and keep in upright position. Crank several times to force water from impeller and water passages.

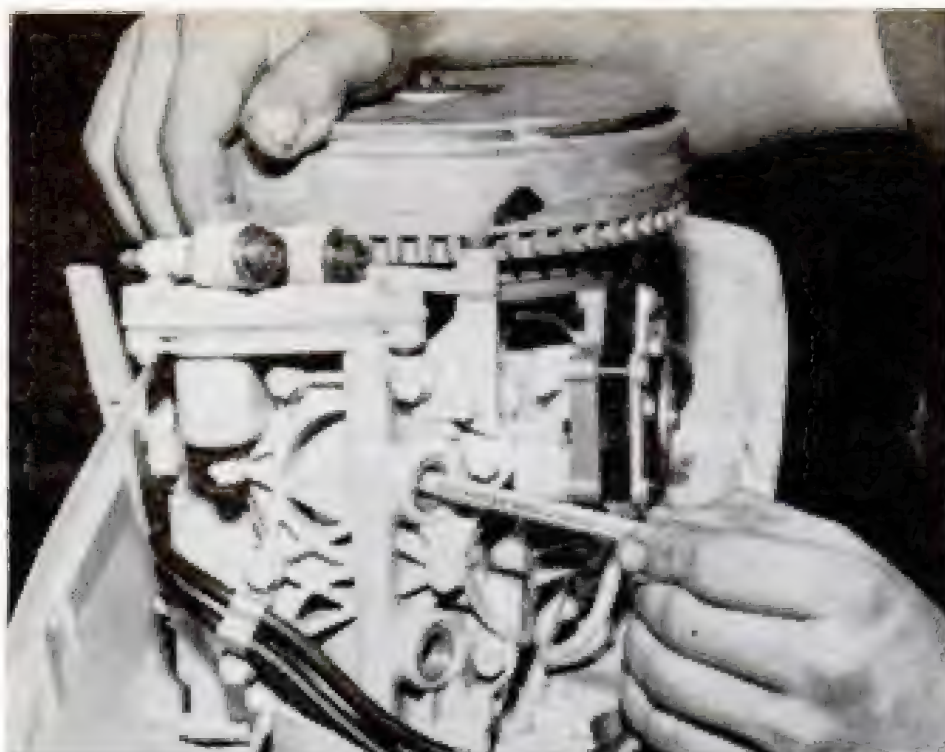


**ENGINE CLEANER** applied through carburetor air intake while engine is running will purge deposits



**DRAINAGE HOLES** in the lower unit may have become clogged. To clean them, use a short piece of wire

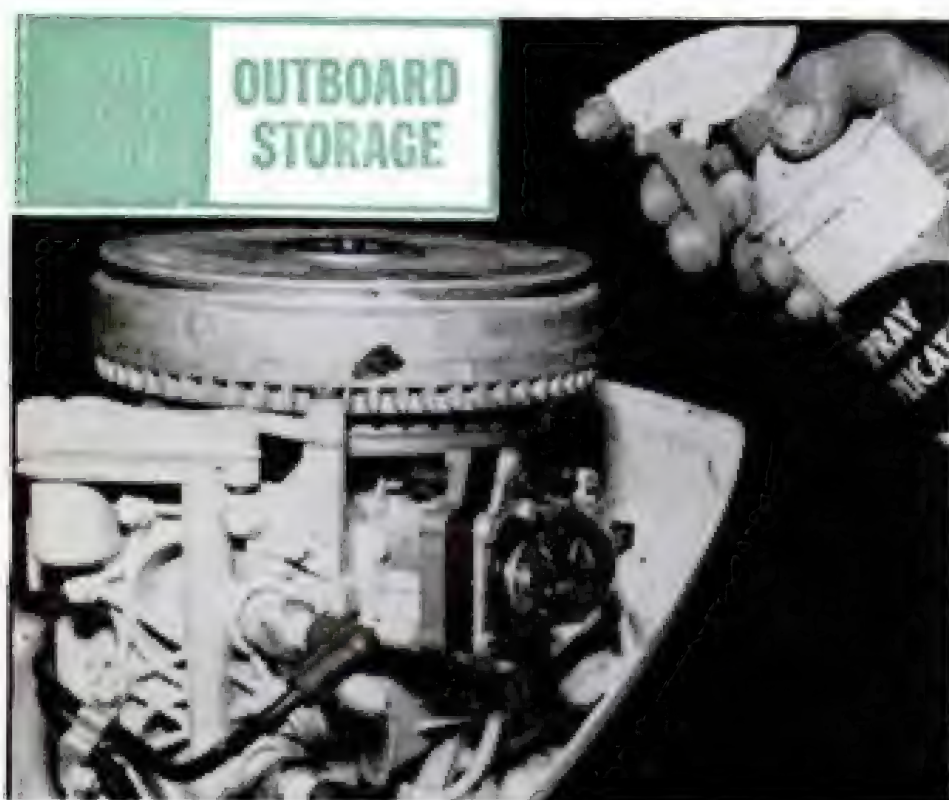




**YOU CAN FEEL** whether the piston is at bottom dead center by inserting a pencil into the sparkplug hole



**LUBRICATE GEAR CASE** in the usual way, squeezing grease through the lower hole until case is filled



**SPRAY POWERHEAD** with a corrosion preventive to protect external parts during long storage period

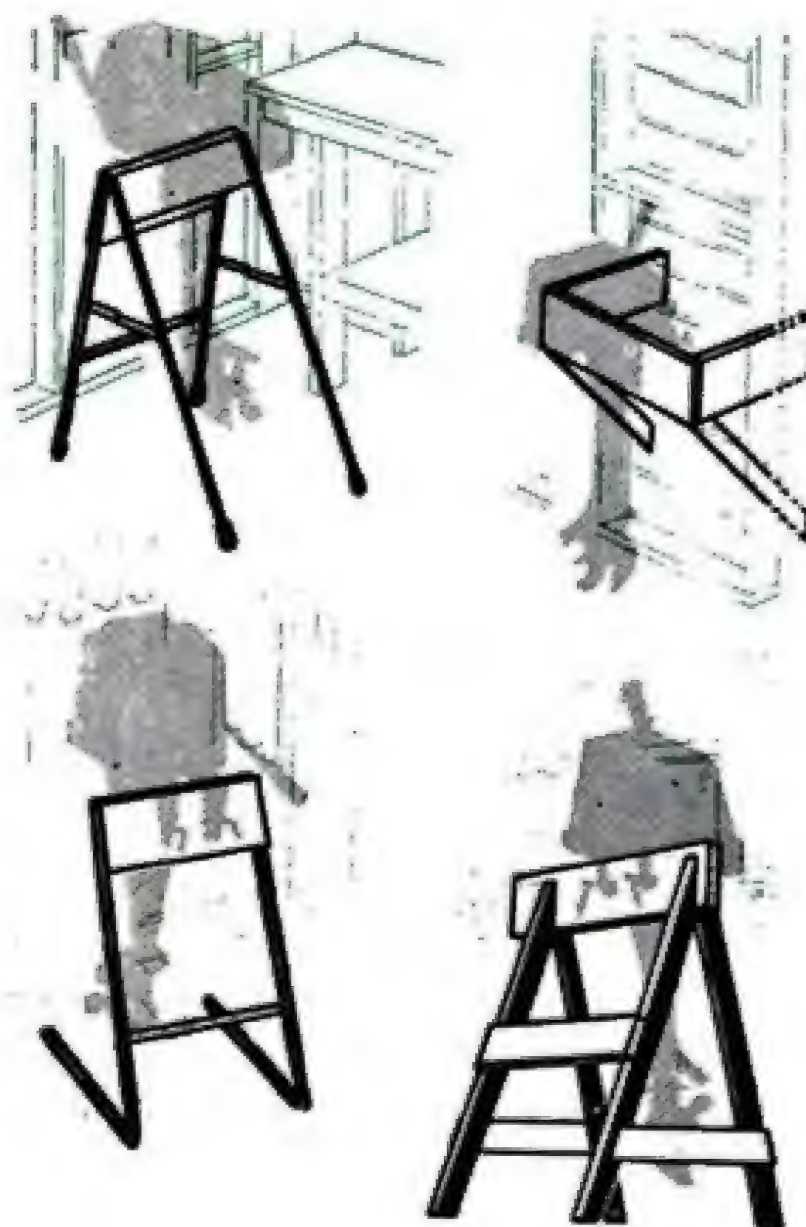
of deposits now present in the engine while storage seal will help prevent rust and corrosion from building up over the period the engine is stored. In short, each product is designed for a different purpose.

So, run the engine at fast idle and apply engine cleaner through the carburetor air intake, making sure that the engine runs long enough (about 10 minutes) to use it all up. Then, after disconnecting the fuel line or turning off the fuel shut-off valve, inject Storage Seal or OMC's Rust Preventive into the air intake. As the carburetor starts to run dry and the engine takes its last few gasps, give it a final liberal dose.

By the way, if you've already removed the motor from the transom, this can be done in a test tank or a big barrel of fresh water, provided the motor is smaller than 40 hp. (Few people are likely to have tanks big enough to accommodate anything larger than that.)

Protecting the inside of the engine over the winter is so important that outboard manufacturers recommend an additional step—adding protective oil or storage seal through the sparkplug holes. Some people might call this redundant, but as our space program proves, redundancy means

**SMALL MOTOR** can be stored anywhere in the house—attic, garage, shop or closet—so long as it's dry







**AFTER REMOVING** the propeller, clean the prop shaft thoroughly with a small wad of medium steel wool

full protection.

Before doing this, however, you should remove the motor from the transom (or tank or barrel). Keep it upright, so as much water as possible drains from the lower unit housing. When it stops draining, carry it to your workshop and mount it in an upright position on a sawhorse, the side of your workbench or some other firm horizontal stand.

Disconnect the sparkplug leads and operate the manual starter two or three times until all water trapped in the cooling system drains out. But make sure all water drain holes in the lower unit are open and free. If there's a flushing plug



**APPLY LIGHT COAT** of graphite or silicon grease to the shaft before you replace the propeller on it

on your model, remove it to permit full drainage.

Complete drainage is especially important if the engine is going to be stored in a cold garage or shed, since any trapped water could freeze and expand, causing the gear housing or water-pump housing to crack.

Now, remove the sparkplugs, and rotate the crankshaft via the manual starter until No. 1 piston is at bottom dead center. You can determine the position by inserting a pencil or dowel into the sparkplug hole.

Apply storage seal or oil through the  
(Please turn to page 224)

## OUTBOARD CLINIC

*My 1963 9.8-hp. Mercury started to idle rough toward the end of the boating season. Why?*  
—S. D. S., New Jersey

**A** That's a good question, but one I can't answer in this short space. There are at least two dozen reasons why an outboard can develop rough idle. The problem could be located in ignition, carburetion or in the crankcase. Incidentally, in next season's outboard articles, we'll try to devote more space to troubleshooting specific problems such as rough idle, overheating, and no-start.

**Q** *My 5½-horsepower Viking outboard runs well at every speed, but there is one small problem. As you speed up from slow to fast, the motor vibrates for about five seconds. I'd like to fix this, if possible.*—B. T., Canada

**A** Chances are your carburetor is running slightly rich and the vibration is being caused when the carb purges itself of the gas it has built up. You may be able to correct it by

re-adjusting your low speed needles to the lean side a bit. But not too much, please.

**Q** *I had an experience during this boating season that may benefit other outboard owners. My engine was continually hard to start when I first put it in the water. Everything checked okay. I finally found the trouble. The carburetor was flooding, but not because of a mechanical problem. I was tilting the engine while lugging it with my trailer. I solved the problem by disconnecting the fuel line on the way to the dock.*—L. T., N. D.

**A** Right, and here are some other tips to stop a similar problem. Tilting the engine while launching the boat can cause the same thing—keep the fuel line disconnected until the boat's in the water. Furthermore, fuel tanks exposed to the sun, or trailered over rough roads can cause pressure to build up that may become great enough to override the float needle when the motor is tilted, allowing raw fuel to enter the intake manifold. This can result in hard starting.

**Any Questions?** For a personal reply to questions concerning your outboard motor, write to Outboard Clinic, Popular Mechanics, 575 Lexington Avenue, New York, N. Y. 10022. Enclose 25 cents in coin



# SAVE YOUR ALTERNATOR

## Build This \$2 Battery

**T**HE WEATHER IS BLUSTERY and getting colder. You hop into the car and turn the key, hoping for a quick warmup to get the heater going. But the battery is colder than you are. All you get is a low moan. You have your neighbor pull his car over to yours as you ready the jumper cables . . . but, whoa? Which side of the battery is which? A wrong clamp and you could burn up your alternator!

Save the worry. You can build a simple polarity indicator in a jiffy, and for less than \$2. The parts (see schematic) include

a diode that can handle at least 2 amps. steady state and at least 24 PIV.

The resistor permits operation of the 6-v. bulb on 12 v., while the diode will block the tester's operation if hooked to the battery in reverse.

Solder the components in series as close together as practical. Use a heat sink or pliers between the soldering gun and the diode to prevent damage to the heat-sensitive diode. If the diode's polarity is not marked, determine it with a 12-v. battery of known polarity before soldering. The



**JUMPER CABLES GIVE QUICK STARTS** with a weakened battery, but be sure of proper hookup to protect the rectifiers in the alternator



**CHECK THE POLARITY** of the battery with the tester. With the clip to the positive terminal and the case to negative, the bulb will light

## AUTO HINTS

- Rear-axle bearings sometimes freeze when you have to remove the shaft. You don't really need a special wheel puller, though. Just install the brake drum inside out with at least three loose lug bolts. Then use the drum as a slip hammer to jar the shaft free.—*Stanley Clark*

- Blocking a tire is a standard practice when jacking a car, but on hills or wet surfaces, the wood wedge sometimes fails. To correct this, make a 6-in.-long wedge from a 4x4 and attach an 18-in. strip of

heavy canvas to the underside. Before jacking, roll the car onto the canvas and against the wedge.—*Frank J. Bradley*

- Safely store your umbrella under the front seat in a cardboard tube obtainable at a yard goods store.—*Arthur Tanner*

- Loose hidden bolts can be a real problem, but a technique used on threaded rotating shafts solves it. When the thermostat bolts on my car became loose and I couldn't reach into the radiator opening



# Polarity Tester

By Ray Shoberg

diode's positive terminal is then soldered to the center contact of the bulb. Tape the battery-clip junction on the shell of the bulb to avoid contact with the case.

Cut the case from  $\frac{1}{2}$ -in. thinwall conduit about 1 in. longer than from the tip of the bulb to the end of the resistor, excluding the free lead. The ends of the case are plugged with  $\frac{1}{2}$ -in. dowels.

At the bulb end, whittle the dowel so as to leave a flat blade on which to clip the positive lead for storage. Groove the plug's side to pass this lead. Drill a series of holes around the case where the bulb will rest so the light can be seen.

For the other end of the case, use a dowel that will reach past the diode. Leaving  $\frac{1}{2}$  in. of it to form a plug, cut away a half-round section and gouge the flat side to form individual cradles for the resistor and diode. Drill a hole through the dowel's center to pass the resistor's free lead, which hooks under one of the  $\frac{1}{4}$ -in. No. 4 panhead sheet-metal screws that secure the end plugs.

In line with the soldered junction between the resistor and diode, hacksaw a slot wide and deep enough to admit a coin to contact this junction. This will permit bypassing the resistor to light the bulb on a 6-v. battery or when the 12-v. battery being tested is very weak.

Finally, mark the positive terminal and tape the tester to a jumper cable. ★★ ★



CUTAWAY AND SCHEMATIC are shown oriented



CIRCUIT ASSEMBLY is quite simple and the parts inexpensive, but the diode must be protected from excessive heat in soldering. Pliers turn the trick

to hold the bolts while unthreading the nuts, I hacksawed into the end of each bolt. With a screwdriver in the groove holding the bolt, the nuts can be loosened with a wrench.—*Donald Harding*

- Guaranteed quick starts on cold-weather mornings are possible if you wrap several turns of a 12- or 16-foot length of electric heating cable around your car battery the night before.—*Neal M. Hanks*

- Sandpapering commutators is a difficult job on some cars like the Ford line, because the access slot is only  $\frac{3}{8}$  in. wide. To beat it, use a soldering-acid brush with

a  $\frac{1}{4}$ -in.-diameter handle and attach a 1-in. strip of sandpaper over the bristles with a rubber band. The tool enters the slot and is rotated 90°. Pressure spreads the bristles to provide good contact for the sandpaper with the commutator.

—*Edward Mayover*

- Not wearing rubber soles is a good idea when you're using an electric buffer to polish the car, since the car will build up quite a charge of static electricity. In any event, you can ground the car by leaning a four-way lug wrench against the car's bumper and the ground.

—*G. E. Hendrickson*



# How to keep those filters filtering

Your car's engine depends on them for clean gasoline, oil and air. Some can be cleaned, others require replacing—the point is, don't just forget them

By Morton J. Schultz

**A** CAR'S PRIME ENEMY IS DIRT. Not so much the road dust that temporarily powders out the shiny finish of the body, but the insidious—and usually microscopic—grit, grime and gook that seeps and oozes into the working parts of the engine.

It's impossible, of course, to block out *all* dirt; keeping out most of it is the best you can hope for. And this is the job of filters.

All cars have at least two filters: an oil filter and an air-intake filter. All cars *should* have a third: an in-line fuel filter. The fact that some cars are still produced without the latter does not mean that an in-line fuel filter isn't needed. It just means that some manufacturers do not consider it essential to the performance and well-being of their product.

**The in-line fuel filter.** You may ask, "Is there really that much dirt in today's gasoline, and if there is, don't the screens

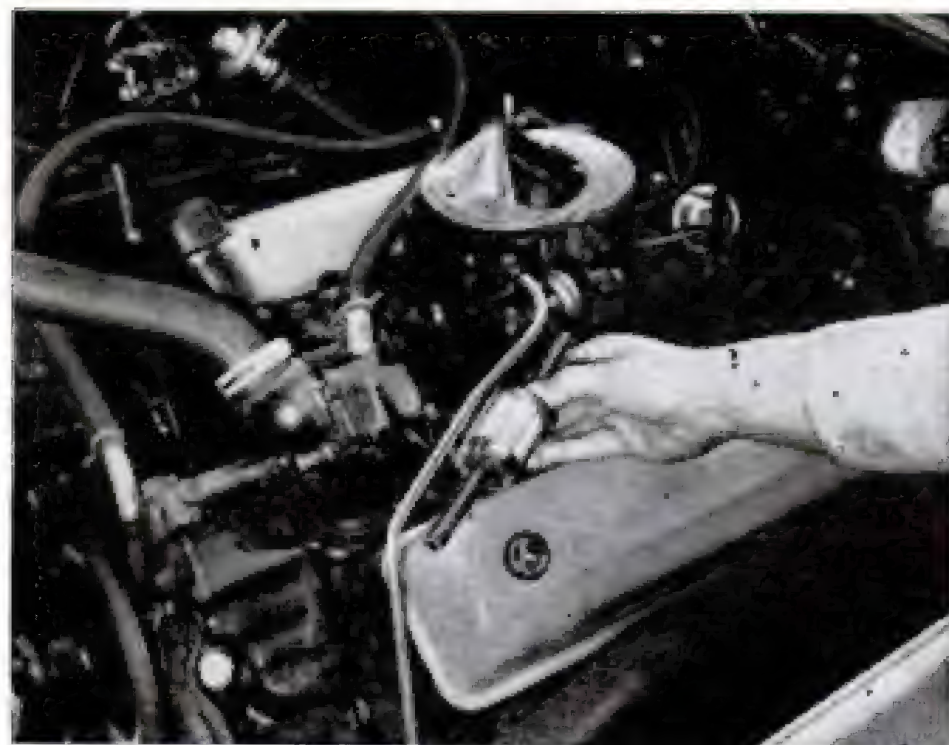
in the gas tank and carburetor filter it out?" While there isn't any dirt in freshly refined gasoline, it can become adulterated from the time it leaves the refinery to when it's pumped into the car's tank, and these screens do not remove all of it.

How does dirt get into gasoline? For one, those big tanker trucks that haul the fuel to gas stations are not always scrupulously clean. The tanks can rust, and such rust can be a highly adulterative element when it mixes with the pure fuel pumped into the truck.

Then there are those big storage tanks under the pavement of your local gas station. These, too, collect harmful sediment that can contaminate the gasoline poured into them.

Even the spout of the pump's gas nozzle can be a carrier of dust, dirt and minute chips of paint picked up from its seat on the pump.

Finally, your car's own gas tank is cer-

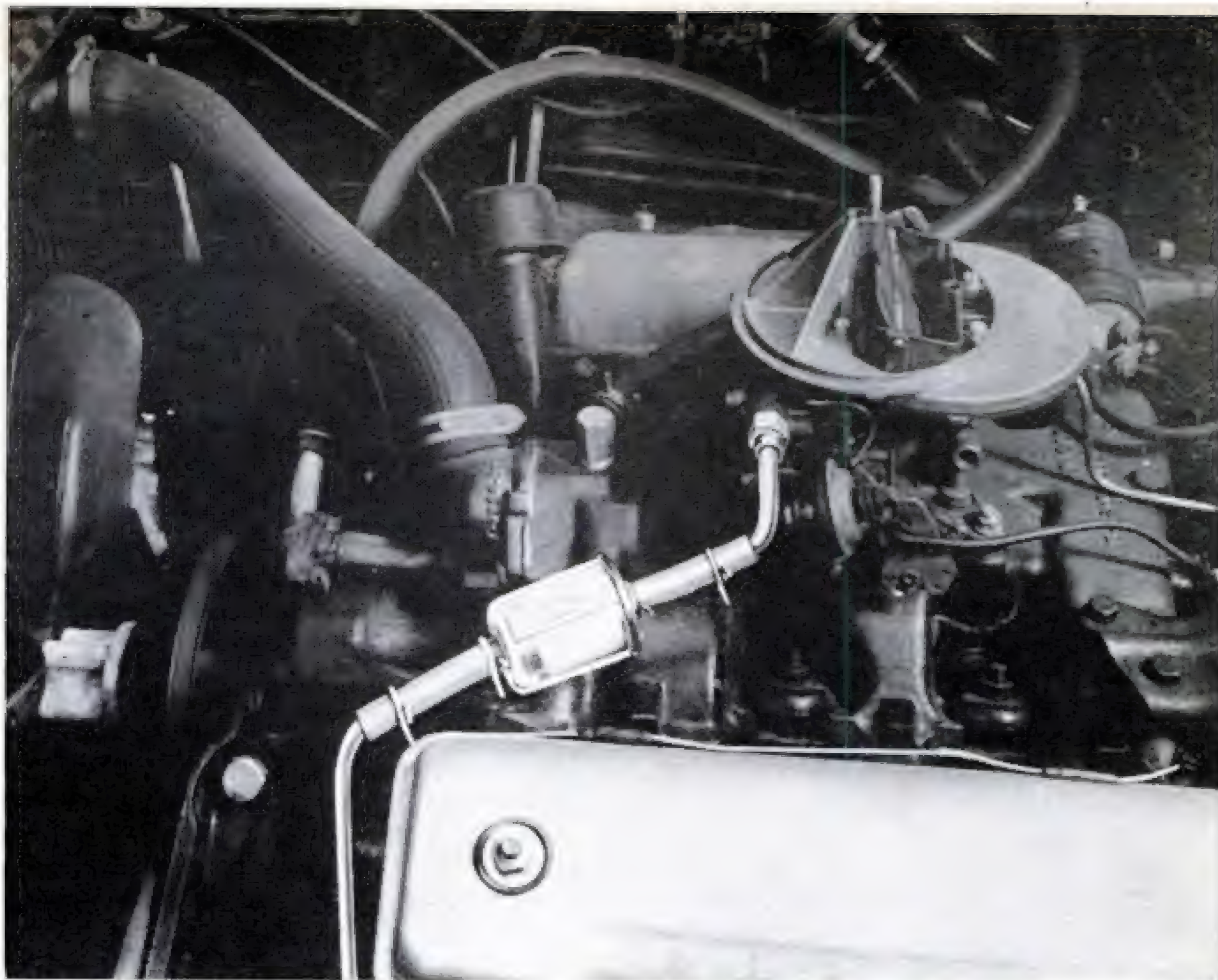


**REMOVE THE AIR CLEANER** for access to the gas line. Check assembled filter and hoses for length



**DETACH THE FUEL LINE** and cut it at a relatively straight section, removing about 3½ in. of tubing





**IN-LINE FUEL FILTER** is cut into the gas line before the carburetor to keep dirt out of the jets

tainly not the pristine container it was when the odometer started ticking off. Sediment in the bottom of the tank can be pumped to your carburetor and the cylinders.

No matter how it gets there, dirt has just one effect on the guts of your engine. It acts as an abrasive that hastens the erosion of parts such as piston rings and walls.

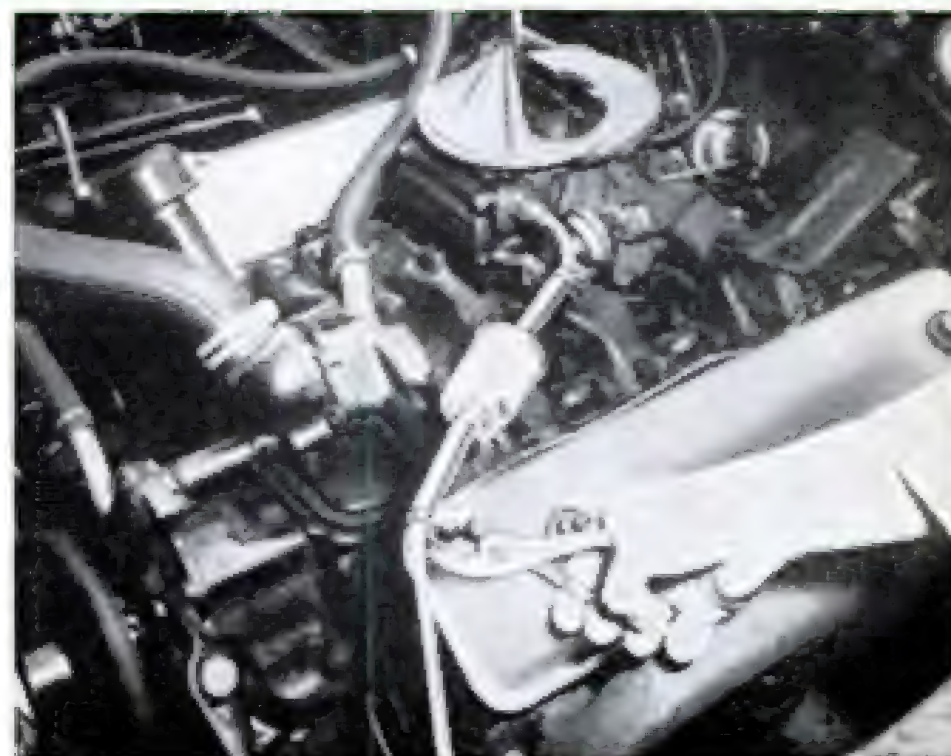
Several gasoline suppliers have added

so-called final filters to their stations' gas pumps. This is evidence enough that keeping gas from becoming contaminated before it reaches a car's engine is recognized as a serious problem. These pump filters help, but they aren't a cure-all. Neither are those filter screens that are built into the gas tank and carb.

The screen in your gas tank is extremely



**PLACE HOSE CLAMPS AND HOSES** on cut tubing ends. Insert the filter, checking for the flow direction



**CHECK FOR LEAKS** by turning on the engine after the gas line has been reinstalled. Adjust the clamps





**POPULAR OIL FILTERS** are the waste-pack with viscose type (left) and those using micronic paper



**HOW DIRTY CAN A FILTER GET?** Here's an example, but you can't check your own without destroying it

coarse and only serves to block out the larger particles of dirt. The screens used in the fuel pumps of some cars are just as coarse. Of necessity, they must be; fine-mesh screens would soon become plugged, thus blocking fuel flow.

What about those screens placed at the carburetor inlet?

"Our research shows that they don't do much good," say Charles Casaleggi, chief engineer at Purolator Products, the largest manufacturer of filters. "Fuel enters the carburetor and loads up the screen. When that screen gets the least bit clogged, it rides up on its spring, then dirt-laden fuel simply bypasses it. When that happens, it's just as if you didn't have a screen there in the first place."

For these reasons, most car manufacturers now install an in-line fuel filter in their cars. This type of filter is, in effect, an integral part of the fuel line between the

fuel pump and carburetor. Its filtering element is either a micronic paper or a metallic or nylon mesh having a very fine pore size of 10 to 30 microns that blocks out most dirt and other foreign matter before it reaches the carburetor.

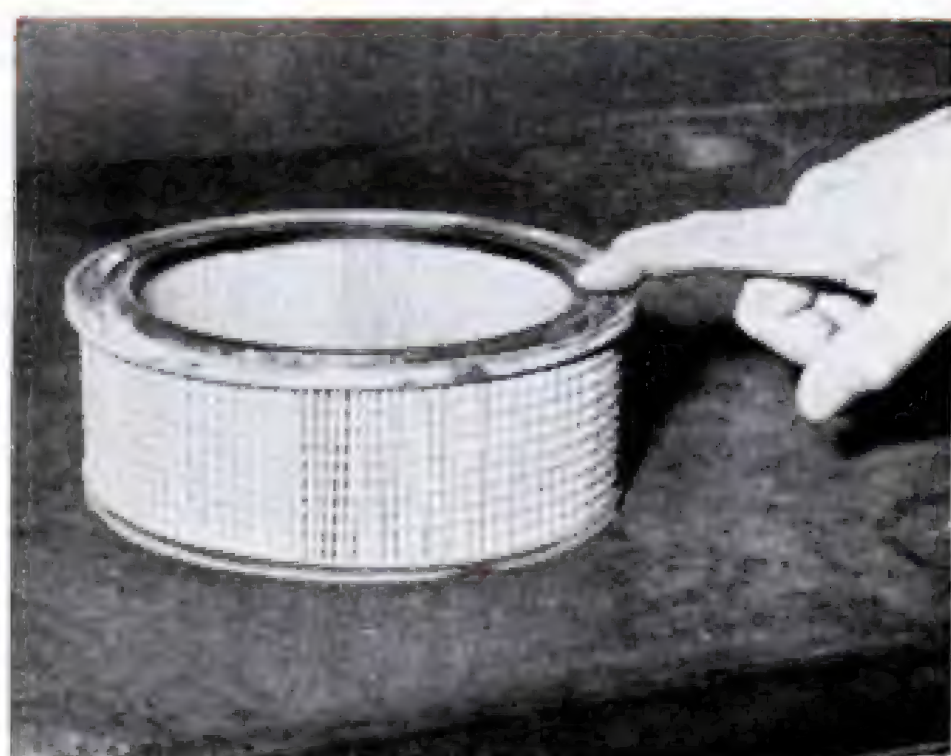
Most cars without factory-installed in-line filters were manufactured before the advantages of this type of fuel filtration were realized. Unless it's a Ford, a glance at the fuel line will tell you if your car is so equipped. Late-model Fords use a filter that screws right into the carburetor. This type achieves the same result as the other filters that install in the car's fuel line.

If your car does not have an in-line fuel filter, you can install one yourself for a couple of dollars. Auto parts dealers sell in-line filter kits to fit practically any make car. Be sure you get one that is the right size for your fuel line. Installation is easy,

*(Please turn to page 217)*



**HAND TIGHTENING** is the slogan for oil filters. Wrenches can crush the canister or ruin the gasket



**AIR CLEANER ELEMENTS** need replacing, too. Top dirt washes away, but the embedded dirt remains



# 6 EASY STEPS TO WATCHING YOUR STEP

Add a wrought-iron railing to your stairs for a measure of safety and an accent of beauty

**A**CCIDENTS IN THE HOME are legion, and a staircase is one of the major danger spots. If you have an unguarded stairway in the house, at the porch or at the front stoop, it's an invitation for a fall. Such spots also are often unappealing—they lack charm and interest. Adding a decorative wrought-iron railing is now an easy job for anyone, thanks to Versa Products Co., Lodi, Ohio.

What makes it exceptionally easy is that the wrought-iron parts go together with nothing but setscrews. All you need for the job are a hacksaw, a screwdriver, a level and, for mounting only, a drill. The manufacturer even supplies an Allen wrench for the socket setscrews.

The photos here and on the next page take you through the steps in adding a railing to a typical interior stairway.



**MOUNT THE FLOOR FLANGE FIRST.** Measure from the outside and side of the step, making sure that a face of the flange is parallel to the riser. Mark holes (above), drill and anchor with  $\frac{1}{4}$ -in. lagscrews





**NEWEL POST IS CUT TO LENGTH** at the bottom, depending on the railing height desired. Standard is 29 to 31 in. The cut need not be perfectly square



**PLUMB THE NEWEL POST** with a level after inserting it in the floor flange. When vertical, anchor it by tightening the slotted setscrews in the flange



**ANGLE THE RAILING** so the balusters will be vertical when mounted. Place your feet on the bottom rail and press on the top rail, a little at a time, checking the angle against the pitch of the steps. Then cut the railing at both ends to keep equal spacing between the balusters and newel post. The cut must be angled the same as the slant of the railing



**NO DRILLING IN IRON IS NEEDED.** Slip the L-bars into the ends of the railings and tighten the socket setscrews on the tension plates. Bend each L-bar to the angle of the cut end. Before mounting on wall, check distances from bottom rail to stair nosings



**FINISHING TOUCHES** are adding decorative scrolls to the balusters and curved endpiece to the newel



# Fireplace wood box

ON THE LONG WINTER nights, a roaring fire can eat up a lot of logs, sending you out into the cold to replenish your supply. But if you fill this big-capacity wood box before the sun goes down, you won't have to stray from the hearth.

Its simple, straightforward design makes it particularly appropriate for an Early American setting—especially if you make it from pine plywood and lumber, and finish it with a warm Colonial Pine stain. But you could also enamel it a dark color and apply decals.

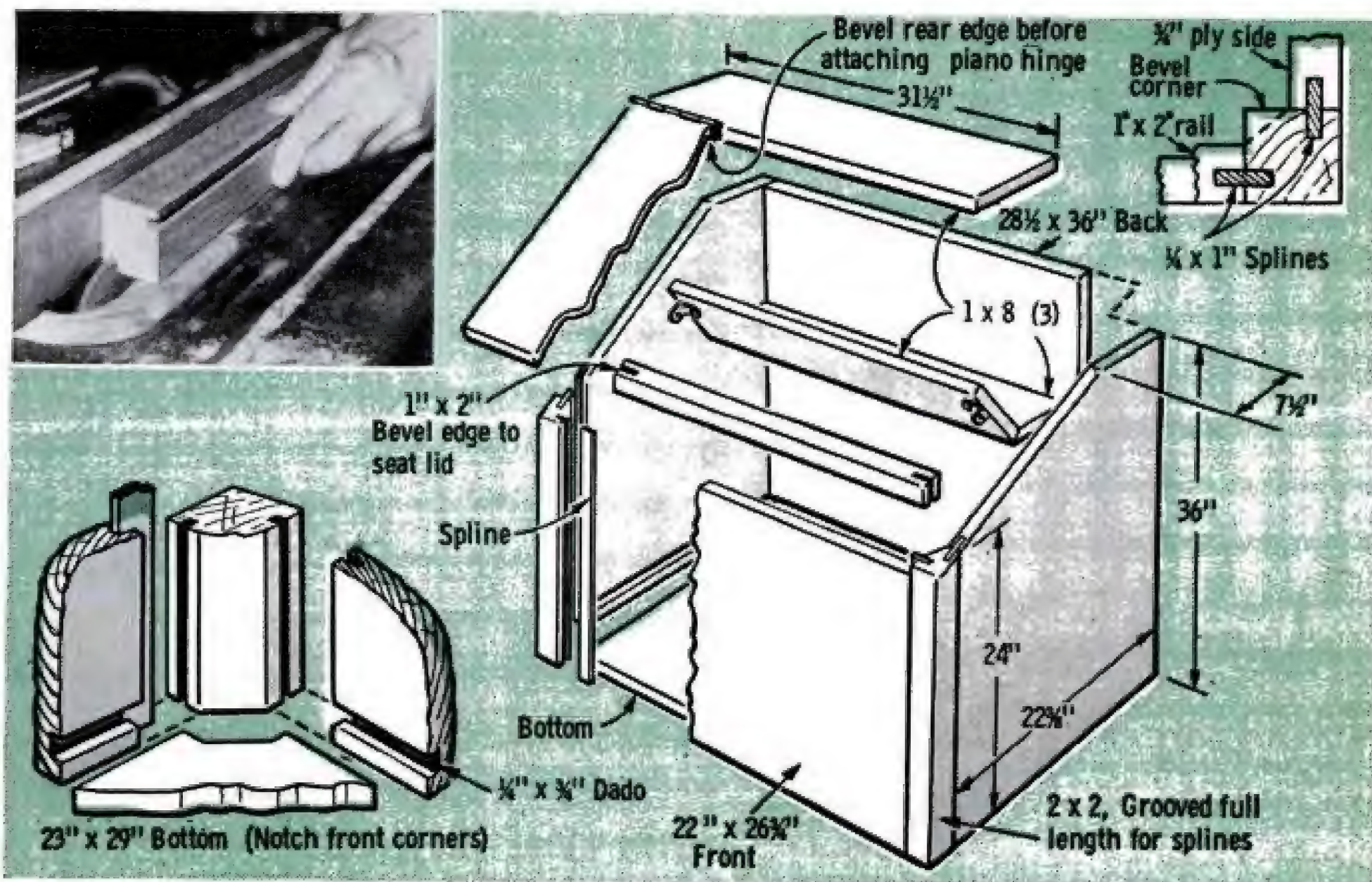
It'll take cordwood more than 2 ft. long, if built to the dimensions shown, and it features a top bin (supported by cleats and steel angles) for kindling and old newspapers. The slanted lid folds against the wall for easy access to the contents.

Construction is simple, except for the splined joints at the front corner posts. The splines are 1-in. strips ripped from



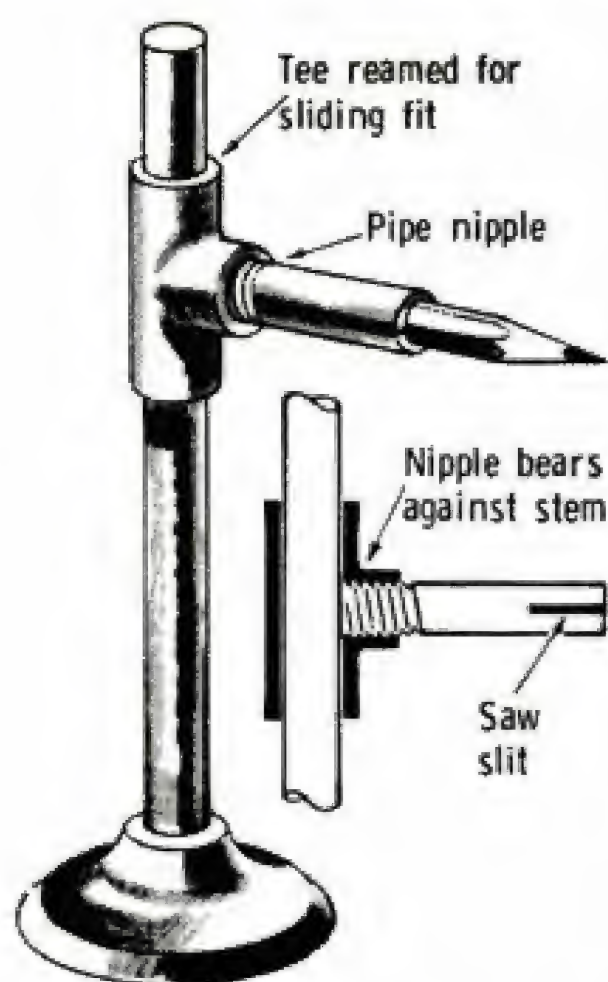
$\frac{1}{4}$ -in. plywood and glued into dadoes cut in both plywood and posts. This feature greatly increases the sturdiness of the unit and adds to its appearance—as does the solid-stock rail across the top of the front panel. Such an edge will withstand the impact and scrape of the logs.

This use of solid stock also solves the edge-treatment problem. The only plywood edges which call for veneer tape are the front and sides of the lid.

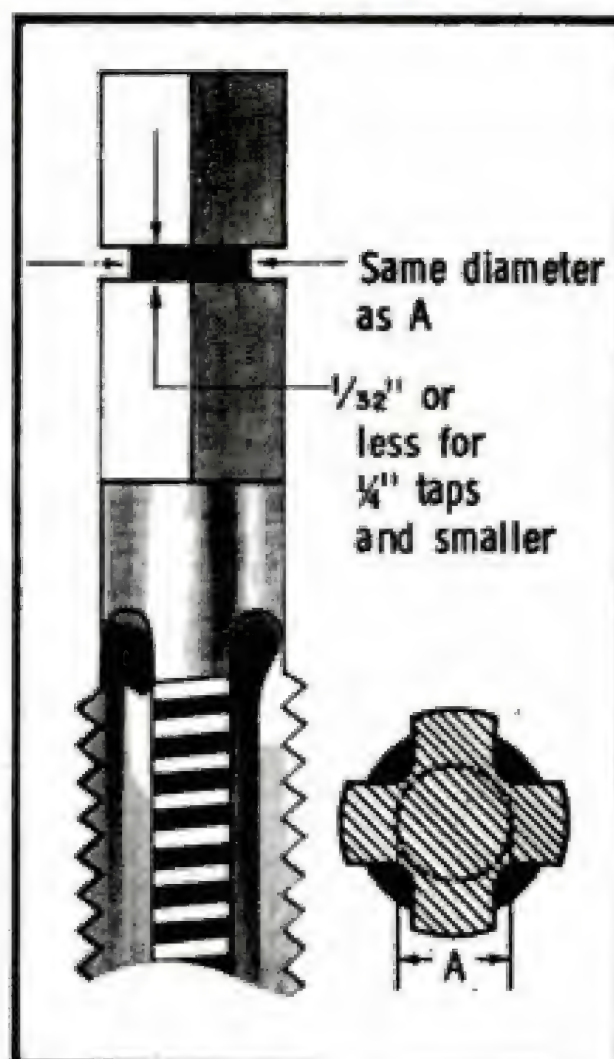




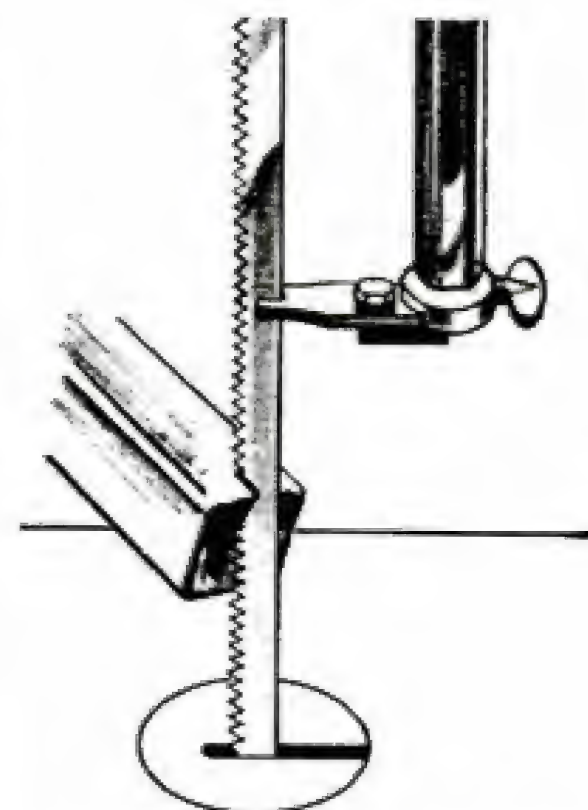
# Helpful hints to make shop work easier



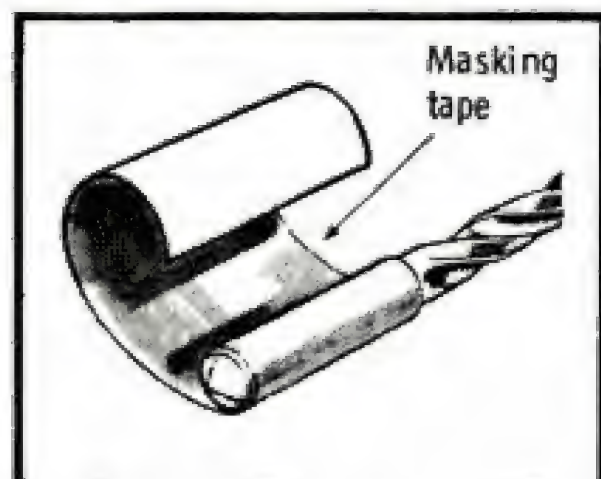
**SURFACE GAUGE** for rough marking work can be made from a discarded auto valve, a .375-in. pipe tee and a coupling. Ream tee to fit valve shaft, and thread coupling so it will clamp to valve



**IF A TWIST-OFF GROOVE** is made in the shank of a tap, you won't run the risk of breaking it off in the hole with too much torque. Should tap break, flats ground below groove let you back it out



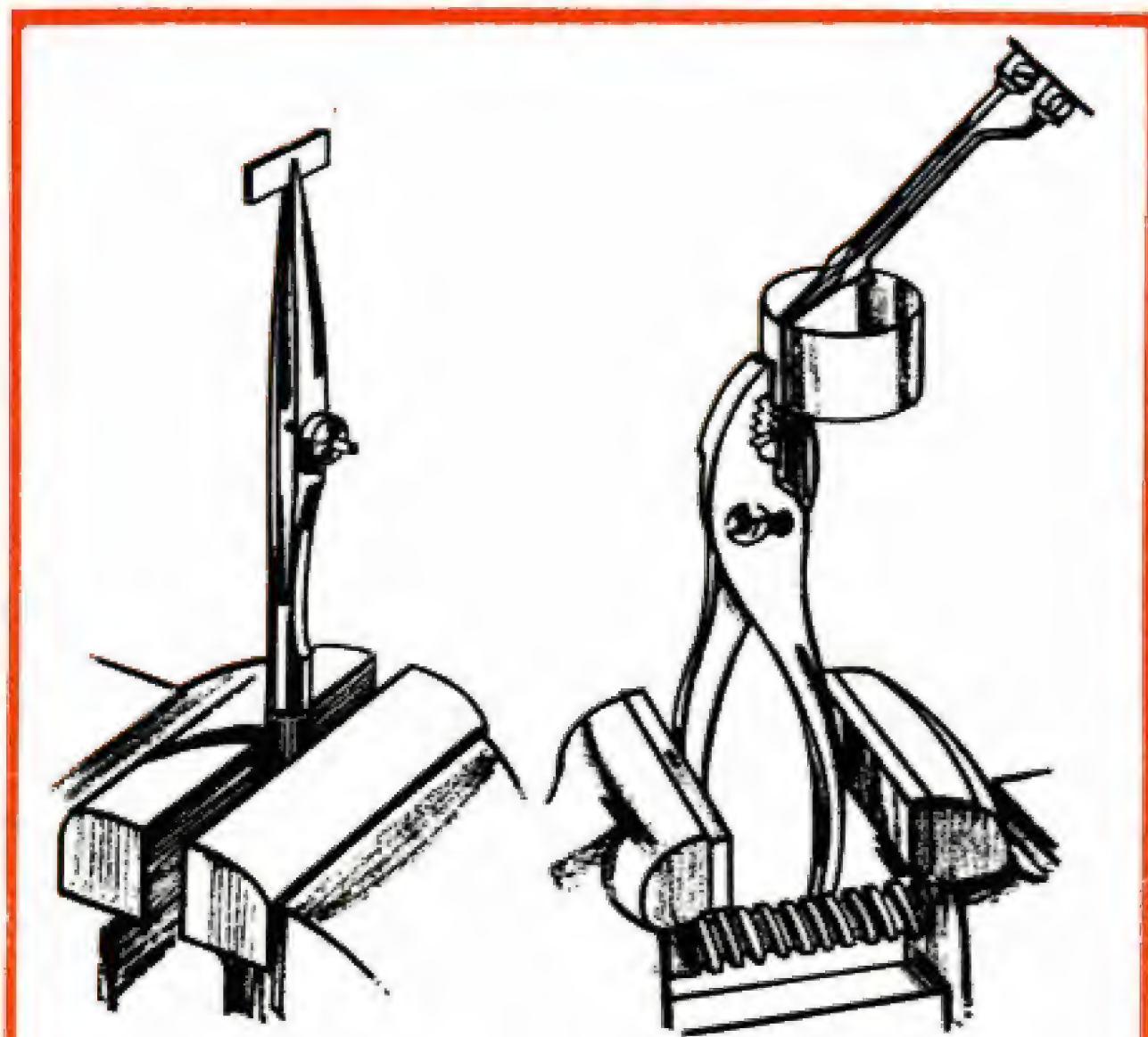
**PARAFFIN STICK** makes an excellent lubricant for a jigsaw blade. Unlike oil, it won't stain wood, yet when applied from time to time to blade it provides lubrication for smooth cutting



**TO ADAPT** a round-shank drill to a brace designed for square shanks, just wrap the shank of the drill tightly with a single layer of masking tape. Such wrapping will prevent any slipping



**IF RULER SLIPS** when marking a smooth surface, substitute a hacksaw blade. The teeth will provide just enough friction to hold it in place. If calibration is required, tape hacksaw blade to a ruler



**MINIATURIZE YOUR VISE** for those small jobs by clamping other holding tools in it. For instance, a pair of pliers held in the vise, as shown above, will not only provide a smaller, more accurate clamping surface but also hold unusual shapes which wouldn't fit the regular vise. For a real "micro-vise," clamp a ruling pen upright in the vise. This arrangement is ideal for holding tiny electronic parts for soldering, since it permits a pinpoint grip and a delicate adjustment of clamping pressure



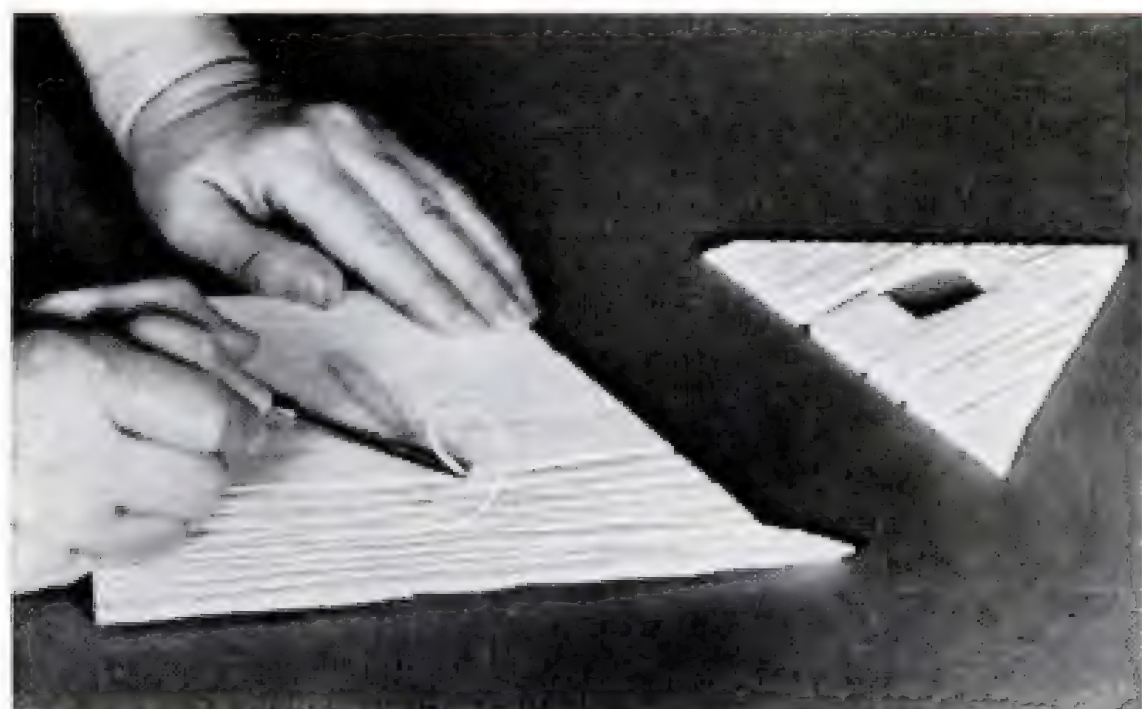
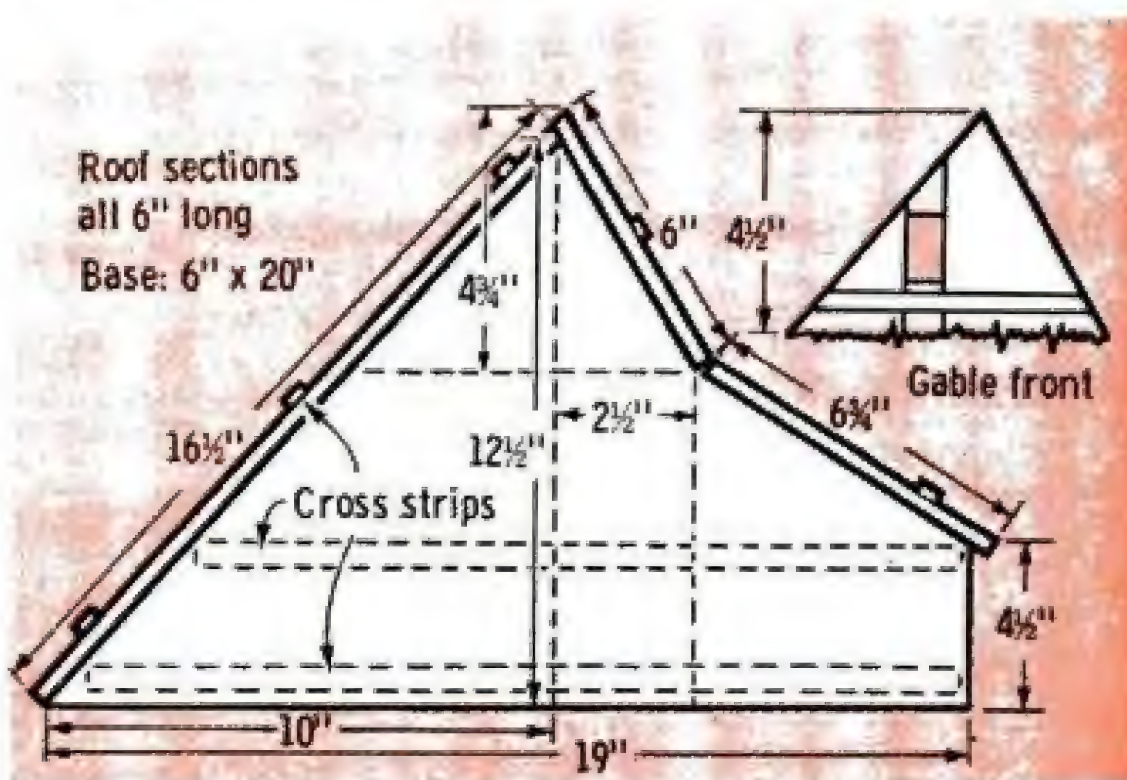


# Christmas projects for tabletop decor

**CRECHE** The most traditional of the four table or mantelpiece decorations presented on these four pages is the rustic stable shown at right (and in color on page 177). If made to the dimensions given, it provides an ideal setting for Nativity figures up to 6 in. tall. Such figures are readily available in variety and gift stores at this season, but an appropriately scaled, handcrafted stable is rarely offered.

For siding, you can use  $\frac{1}{4}$ x6-in. pine, with  $\frac{1}{8}$ x $\frac{3}{4}$ -in. strips for the cleats, battens and eaves planks. One-inch twigs form the roof-support posts. After grooving surfaces and carving edges for a weathered effect, apply a maple filler-stain and immediately wipe it off all faces, leaving the grooves a darker color. When the stain dries, sand the siding panels to add highlights, then assemble with glue and brads. As a nest for the figures, cover the base with clipped straw or pet litter.

**RUSTIC EFFECT** comes from "weathered" siding and tree-trunk posts. Texture siding and chip plank ends with v-gouge (below) then nail one plank across twigs (right)







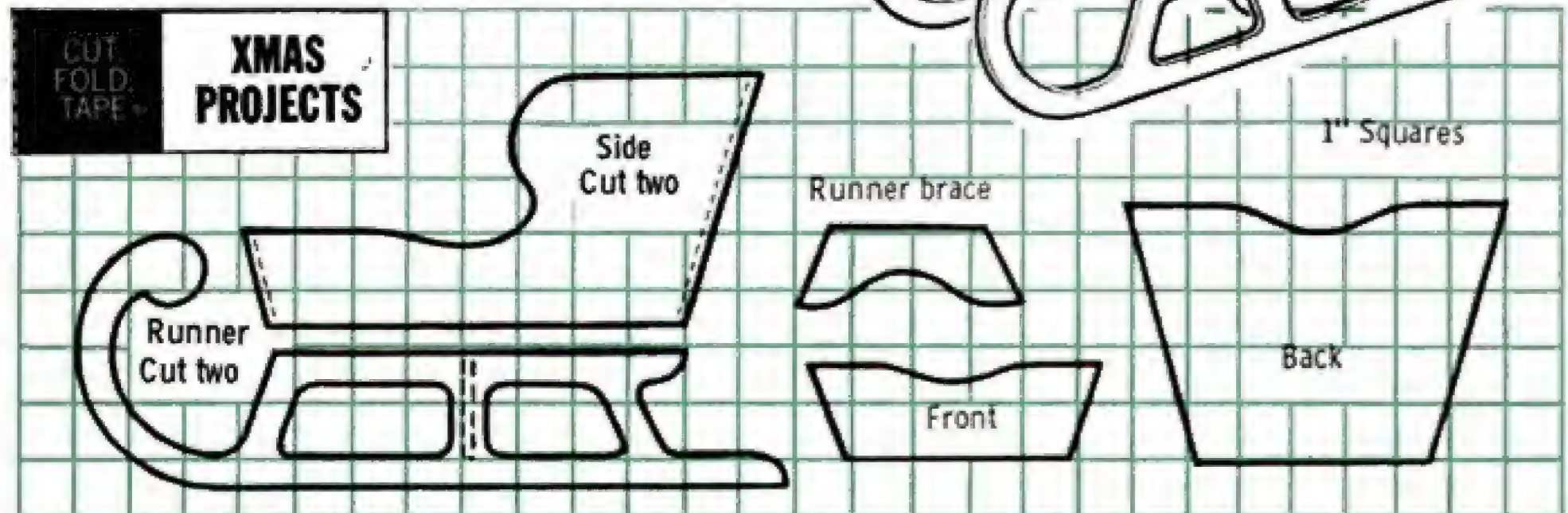
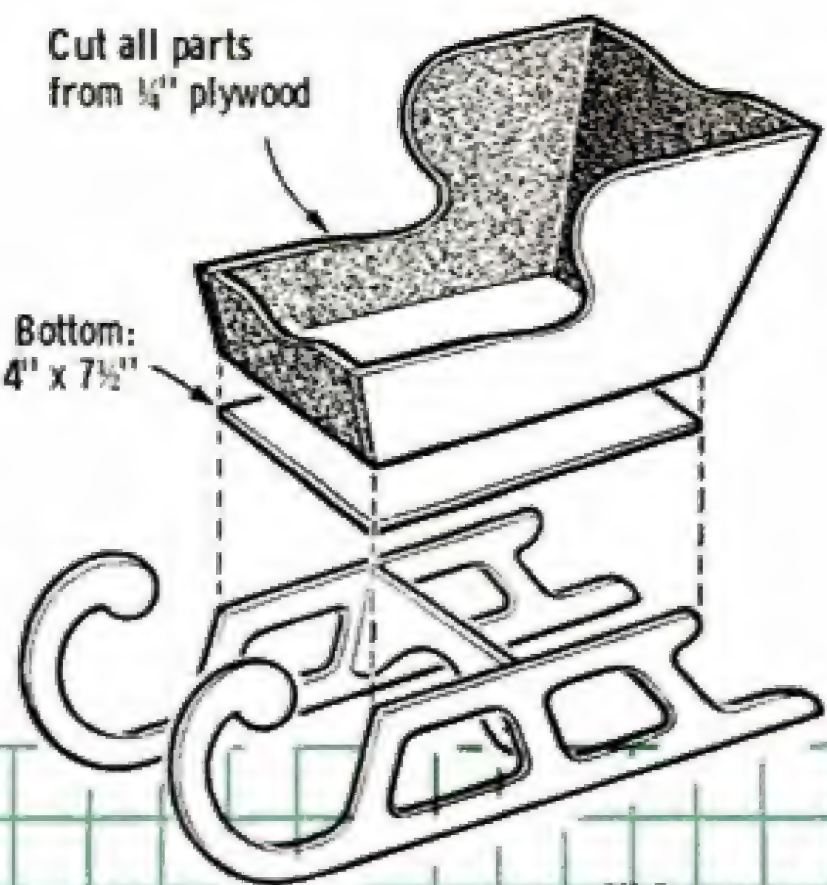
**CARD SLEIGH** The annual blizzard of Christmas cards is about to blow your way, and you can make your collection an intimate part of your holiday decor if you

park the cards in this handsome sleigh—to keep them at hand for review by guests.

The graph-squared patterns below are easy to enlarge and trace onto  $\frac{1}{4}$ -in. plywood. Assemble the four sides of the sleigh as one unit and the runners and bracket as another, then rub their straight edges on coarse sandpaper so they'll make flat contact against the bottom panel.

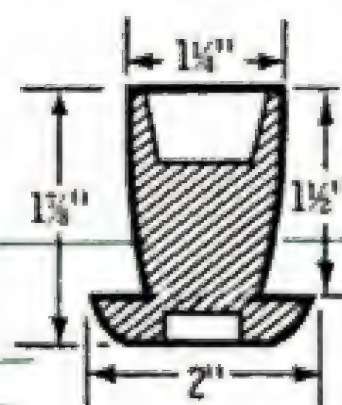
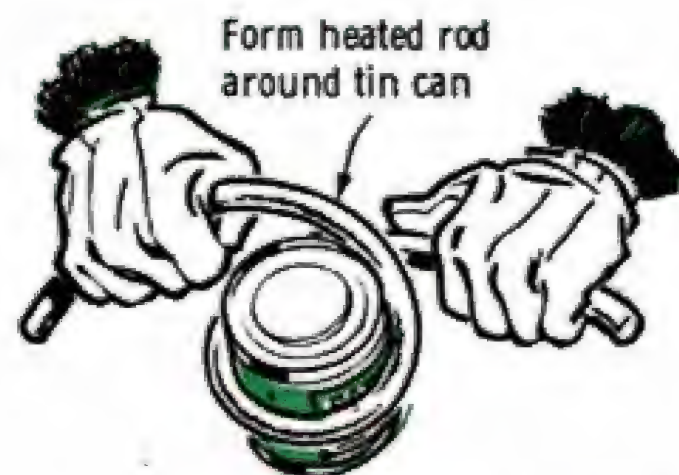
Cut all parts from  $\frac{1}{4}$ " plywood

Bottom:  
4" x 7 $\frac{1}{2}$ "

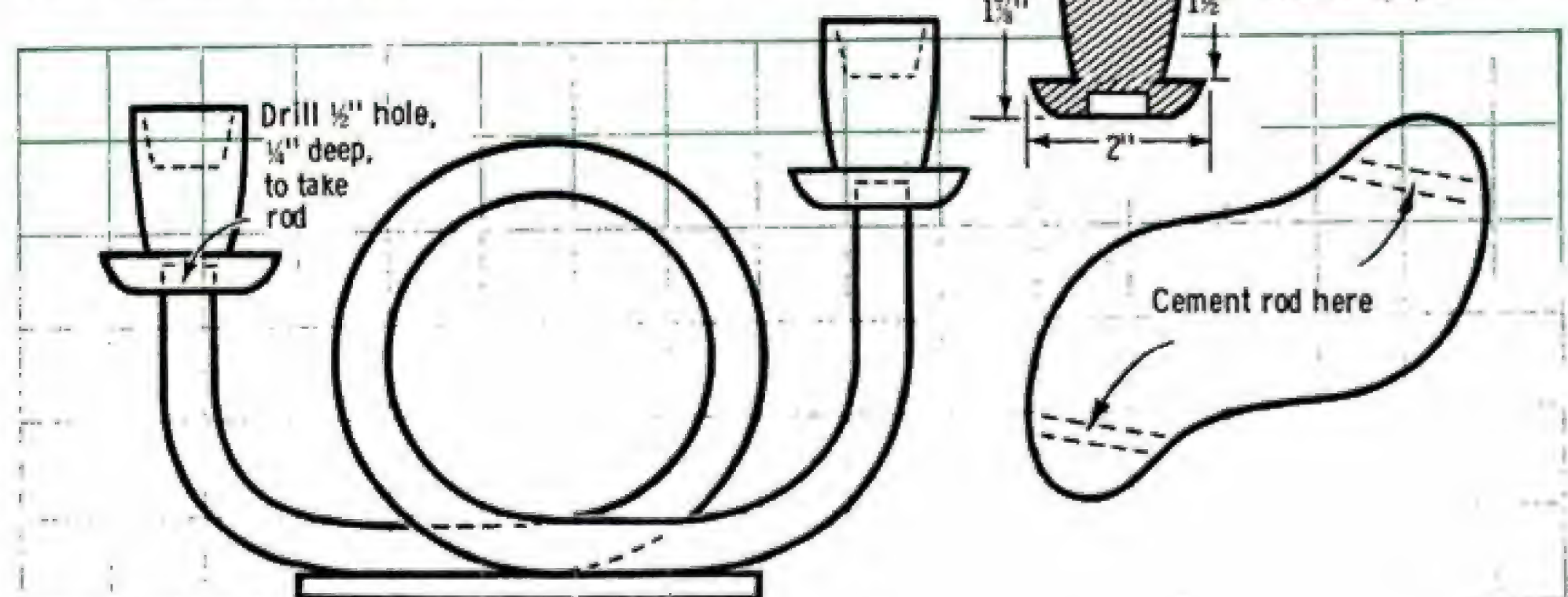


**CANDELABRA** A twist of sparkling plastic rod is tipped at each end with a turned hardwood candlecup to form a beautiful centerpiece for your Yule table or buffet.

Place a two-foot length of  $\frac{1}{2}$ -in.-dia. rod on a cloth-covered cookie sheet in your kitchen oven, preheated to 300° F. When it's flexible, form it around a large can, as shown (right), wearing clean work gloves. Hold the ends parallel until the rod cools to hold its shape. Enlarge the pattern for the free-form base, cut it from  $\frac{1}{4}$ -in. plastic sheet and cement as shown.



Turn cup in one piece, drill  $\frac{3}{8}$ " candle hole and taper it slightly with sandpaper







**Card sleigh**



**Candelabra**

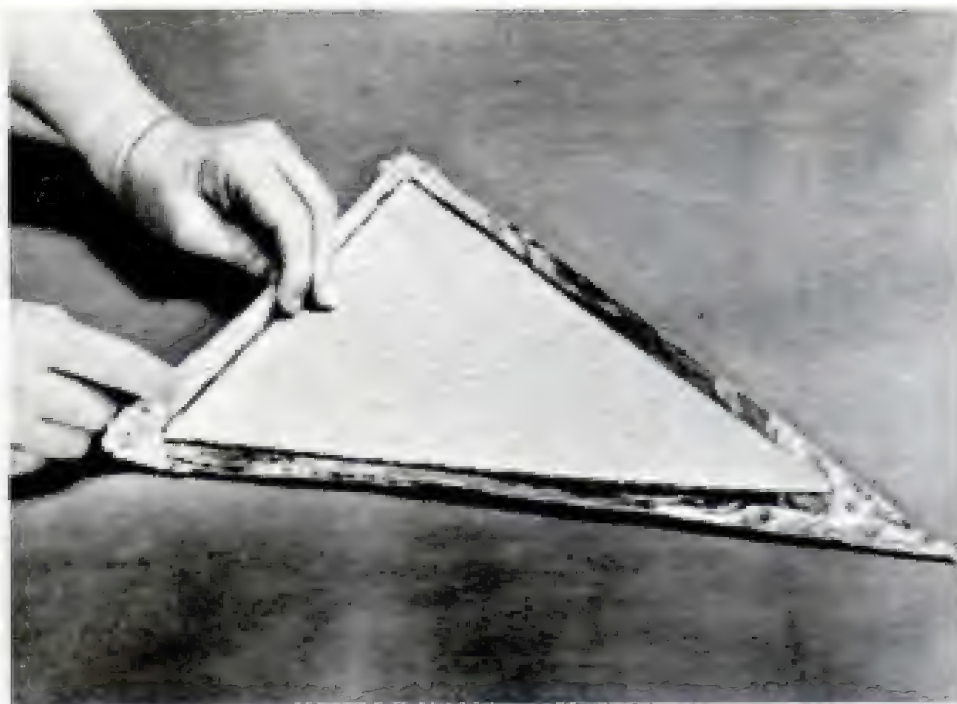


**Glo-lamp**

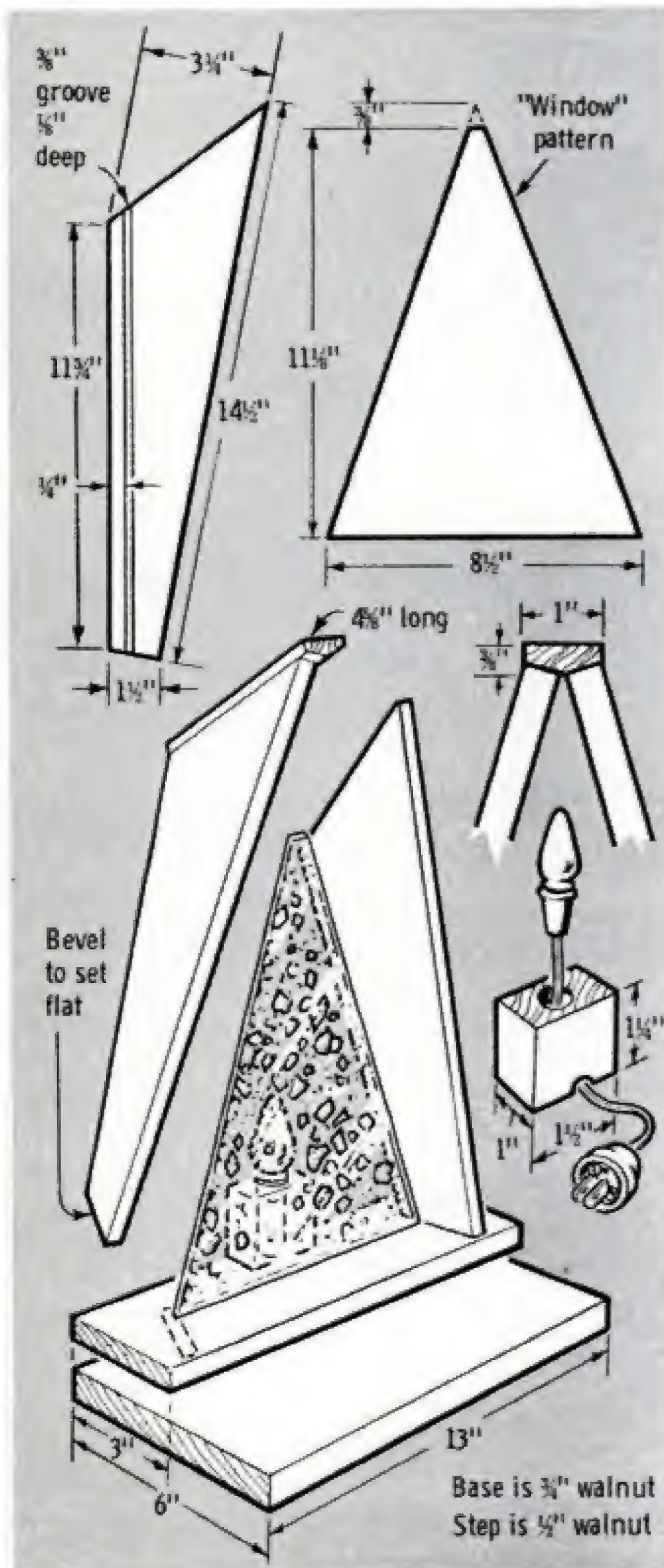


**Crèche**





**CUT CARDBOARD TRIANGLE** the size your glass should be, use it as form to shape tray from heavy foil



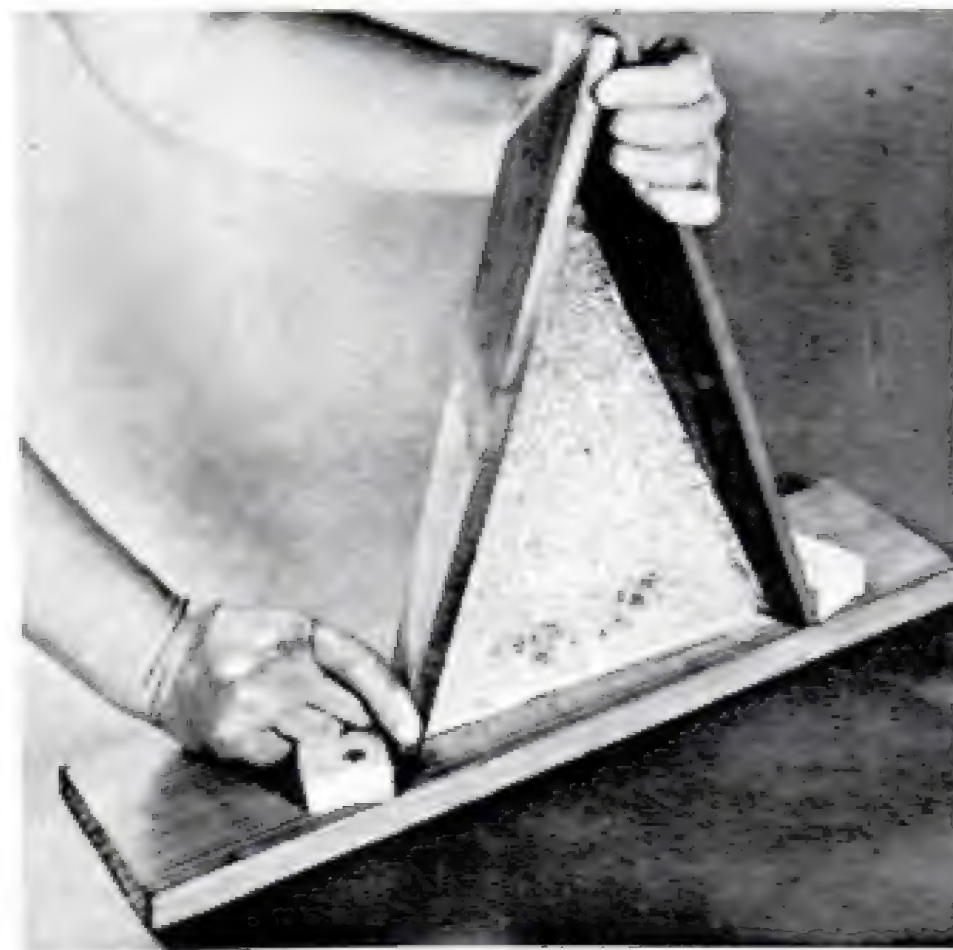
**GLO-LAMP** Modern as a contemporary chapel, this custom-designed "stained-glass" window creates a glowing frame for a Madonna or angel figurine.

Form a 1/2-in.-deep tray of heavy-duty aluminum foil as shown at right, remove the cardboard and place the tray on a cookie sheet. Over a layer of plastic crystals (available in hobby shops) lay colored glass chips in any design you wish, leaving a 1/2-in. margin of crystals at the edges.

Bake, following directions on the package of crystals. When the pane is rigid, remove the foil and check against the template, sawing or filing uneven edges. Cut side frames from 1/2-in. walnut and dado as shown. Cut the triangular ridge-pole to match the angle formed where the frames meet at top. Fasten the glass into the dadoes with contact cement. Bore through the socket block and file a taper to take a pigtail tree socket.

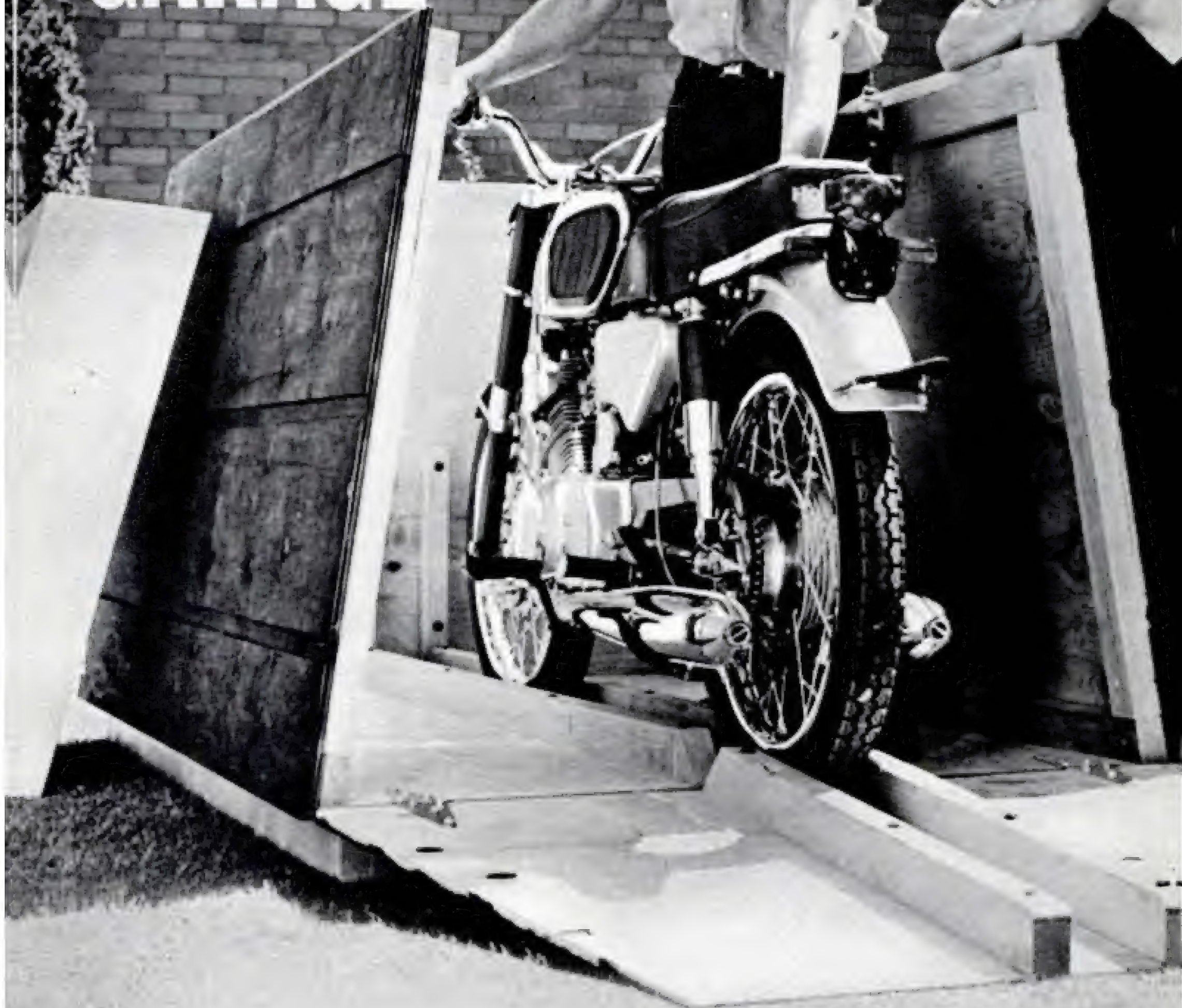


**SPREAD LAYER OF CRYSTALS** 3/8-in. deep in tray and add pattern of color chips. After pane is baked, glue it in rabbets by means of assembly jig shown below





# PARK 'EM IN THEIR OWN GARAGE



Where do you park a motorcycle, mower or tractor when your garage is already bursting at the seams? In a garage all its own!

PLEASE TURN PAGE



CUT  
FOLD  
TAPE

## MIDGET GARAGES



**TRACTOR BARN.** While suitable for any of the three vehicles, the tapered design of this shelter makes it ideal for a narrow-front yard tractor, such as the Cub Cadet shown here. The fold-back roof (below left) is equipped with a handle to make it easy to lift the hinged sections. When open, these stand by themselves



**I**F THERE'S ROOM in your garage for that rider mower you bought last summer, you're lucky. In most cases, there's little or no extra space to park such a vehicle. The average garage is already crowded to the rafters with a hundred and one household items that hardly leave room for the family car.

A bulky vehicle such as a motorbike, rider mower or a family-size yard tractor, is usually left out in the cold when it comes to sheltered parking. And while a tarp, perhaps, offers the next best thing

Color photos by Frank P. Fritz





**DRIVE-THROUGH SHELTER.** You can drive in as well as drive right out of this little garage since it has doors at both ends. Roof sections, which lap one another, fold up and over, one being held vertical by long hooks and screw eyes. While twin ramps merely rest level with floor, they could be hinged to fold up inside unit

to a permanent shelter, it provides far less protection and convenience than a separate little "garage."

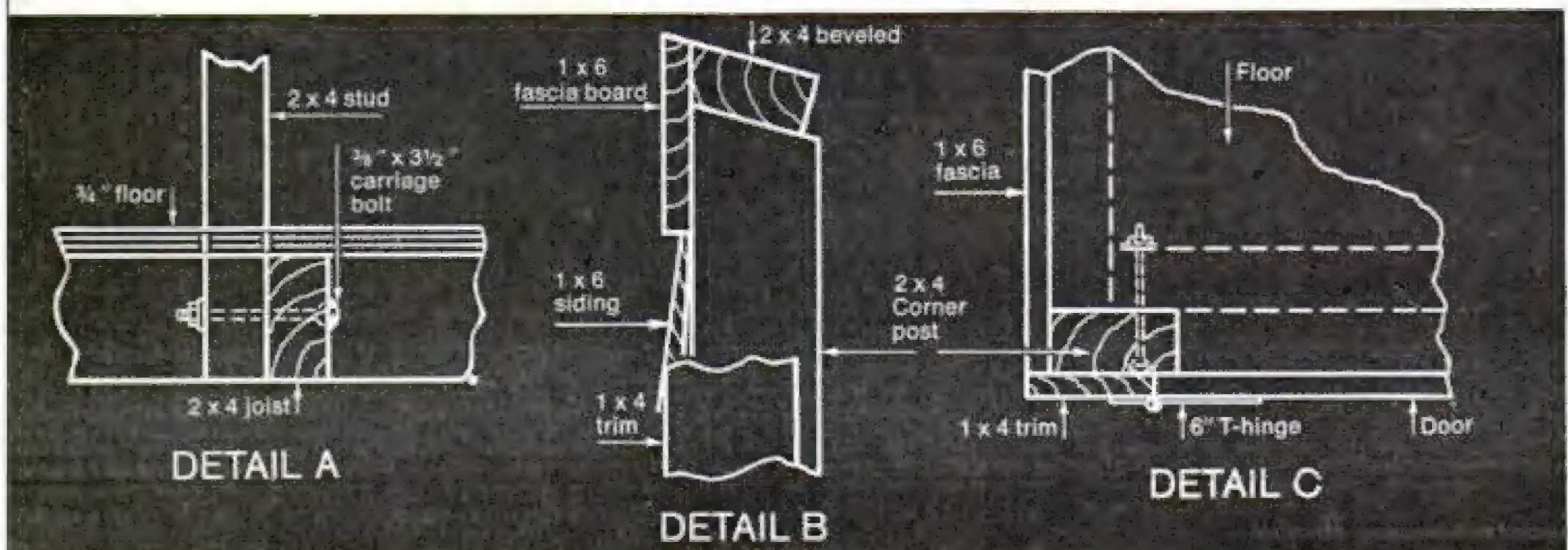
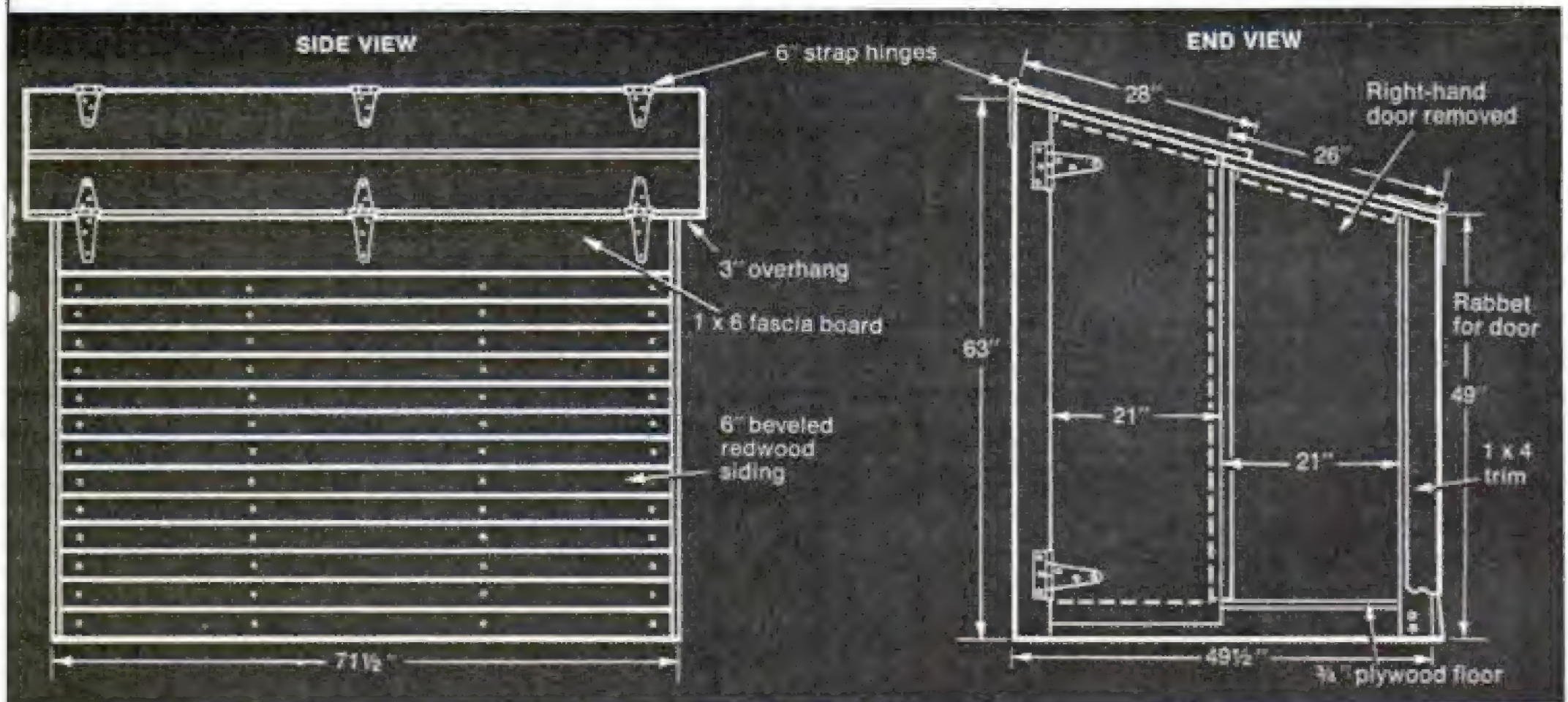
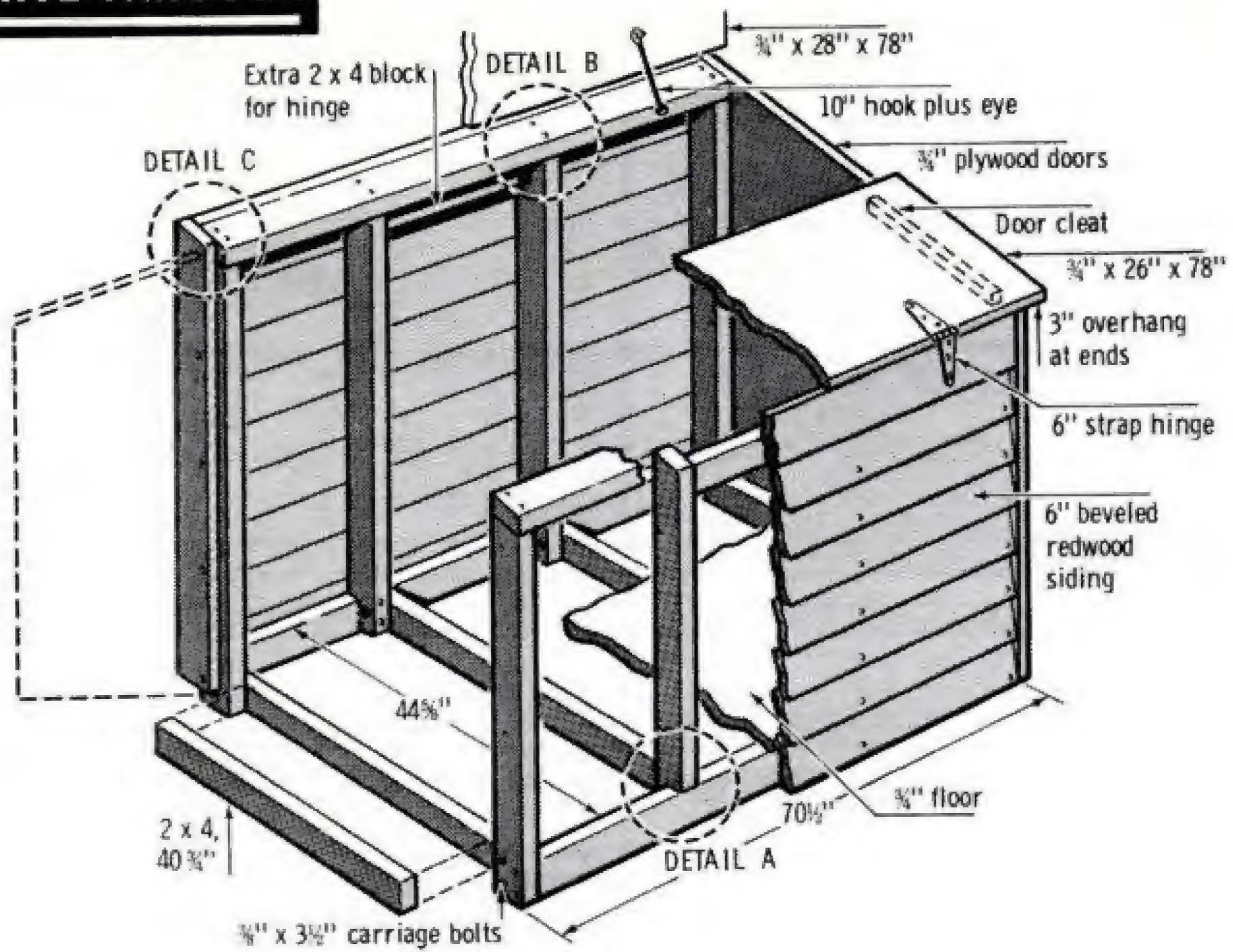
This is particularly so in the case of a motorbike which may be used daily to provide transportation to and from the station. Having a cozy little stall where it can be wheeled in and out and kept high and dry, makes overnight parking as handy as can be.

Equally as handy for a rider mower or yard tractor, one of these little huts located right out in the yard at the rear of





# DRIVE-THROUGH



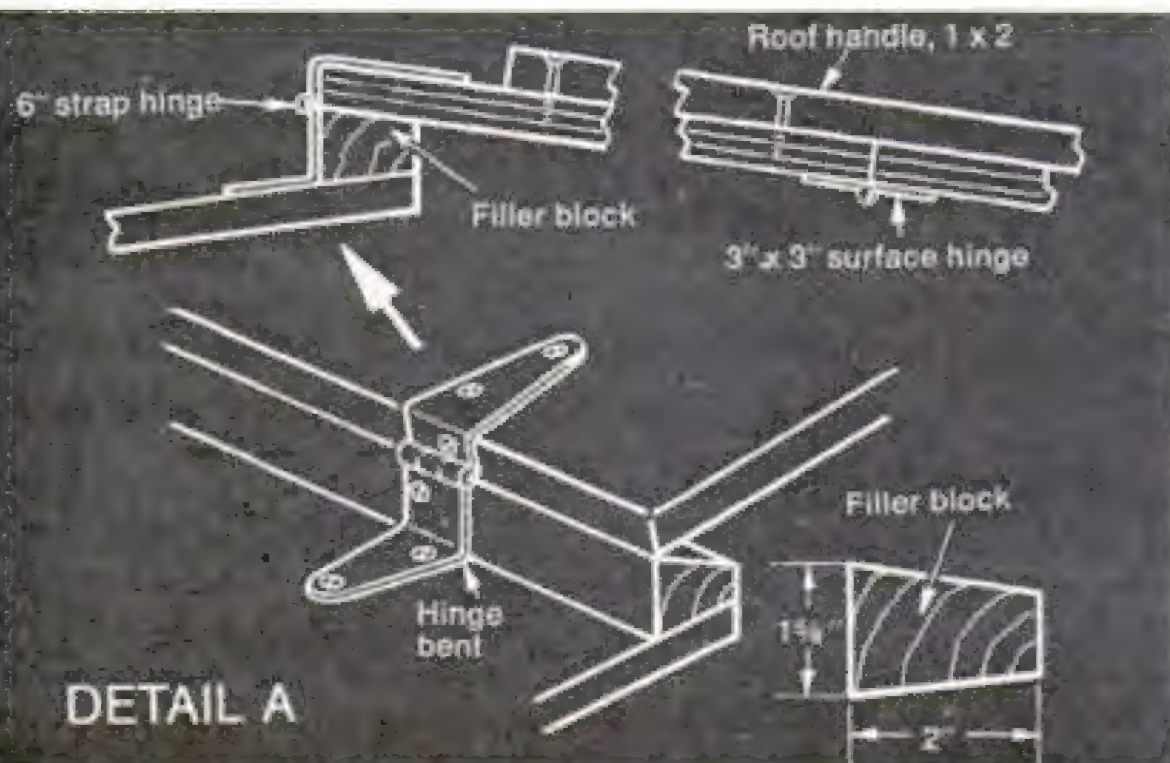
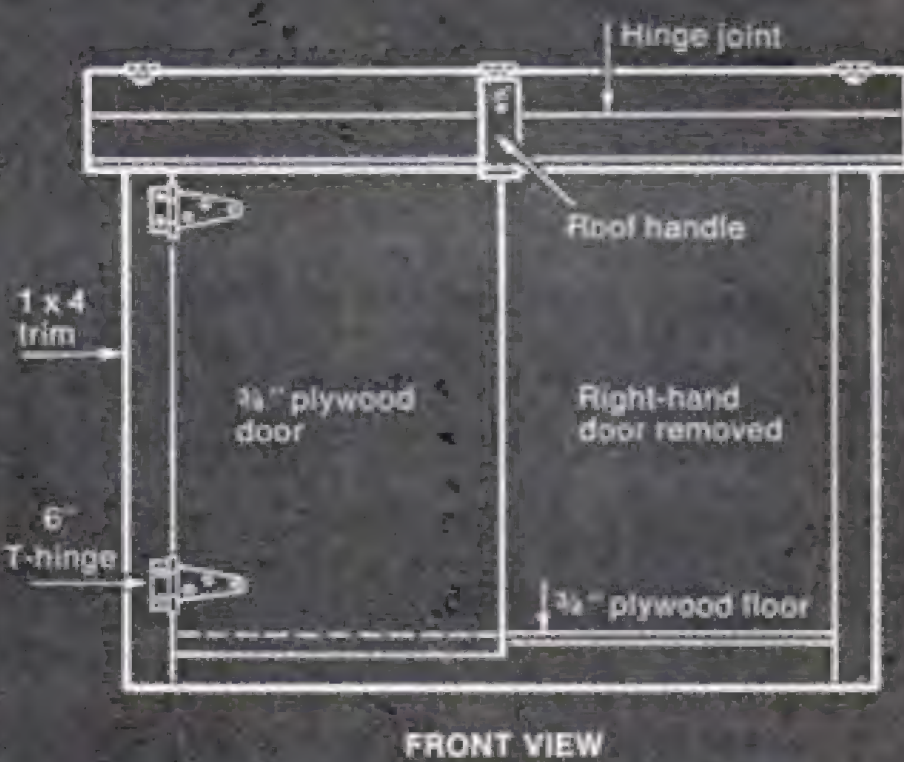
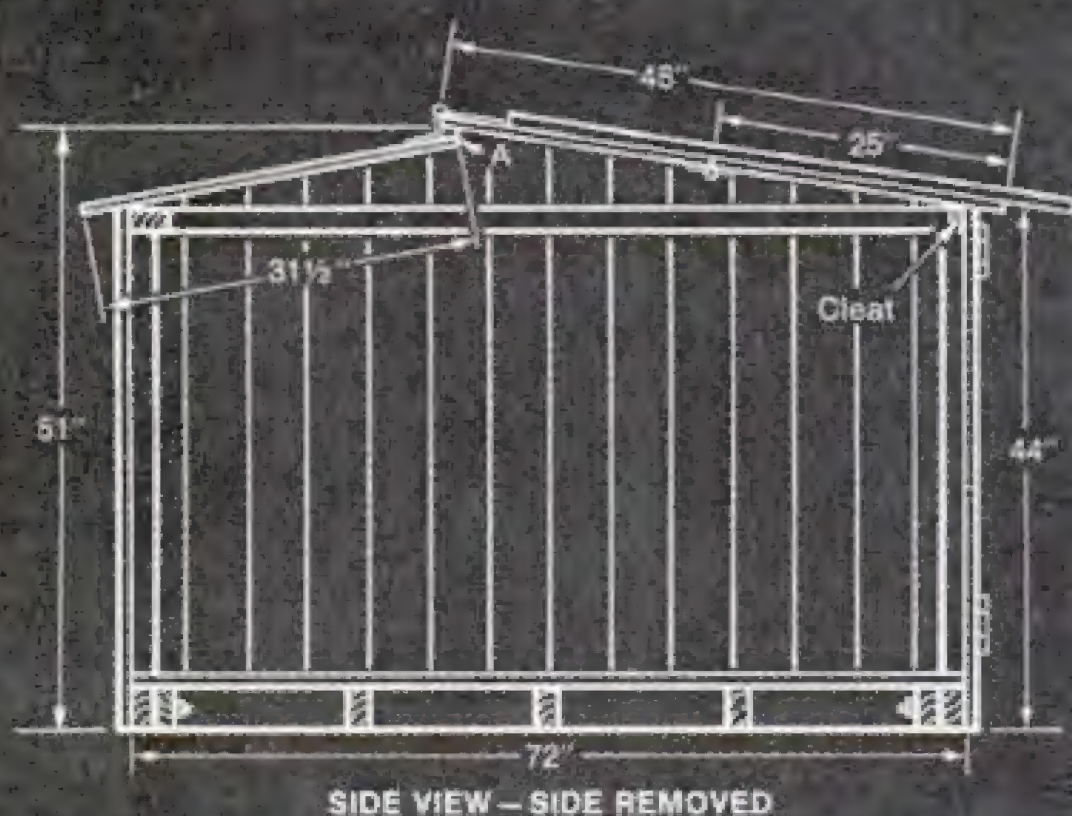
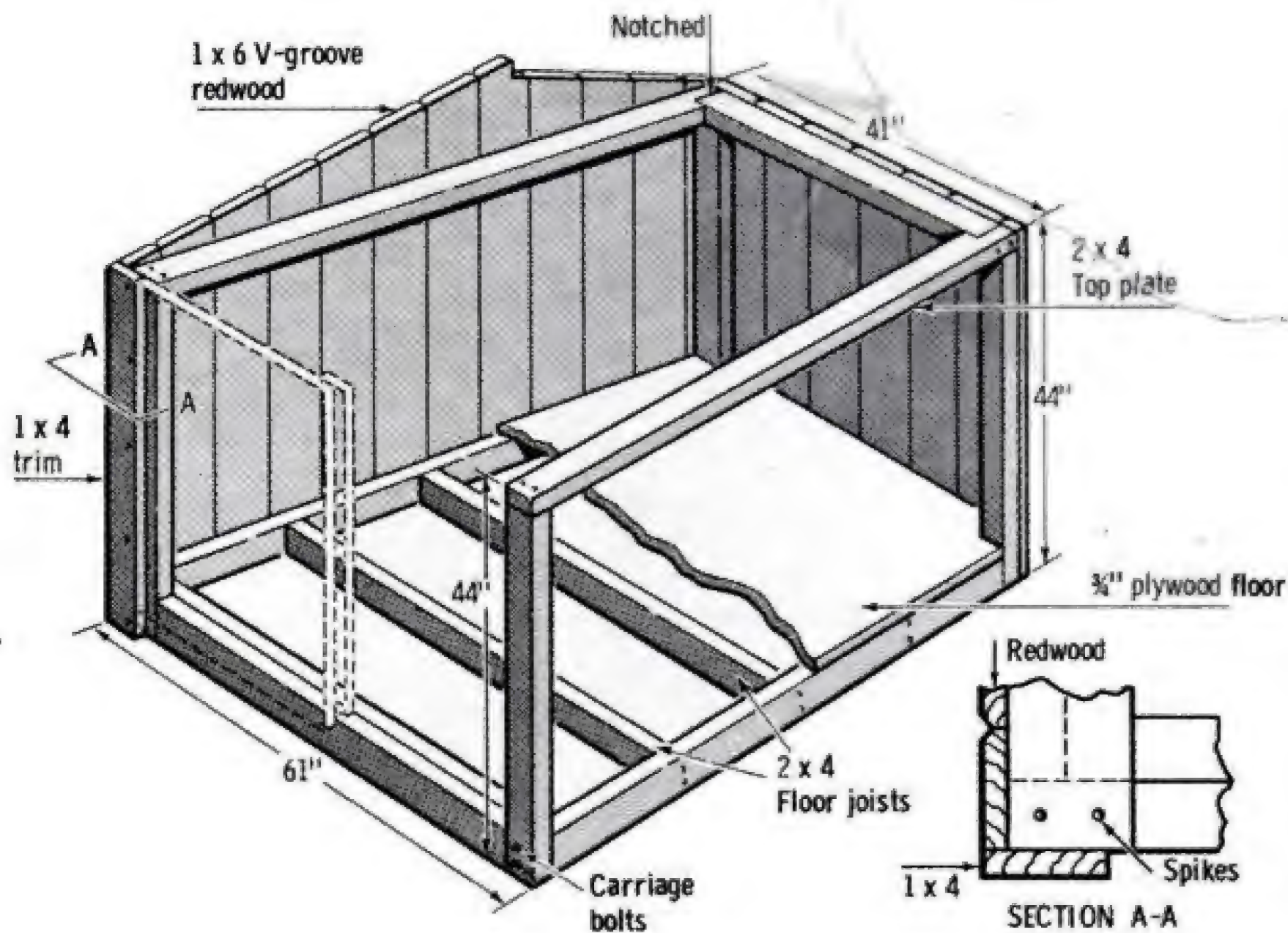




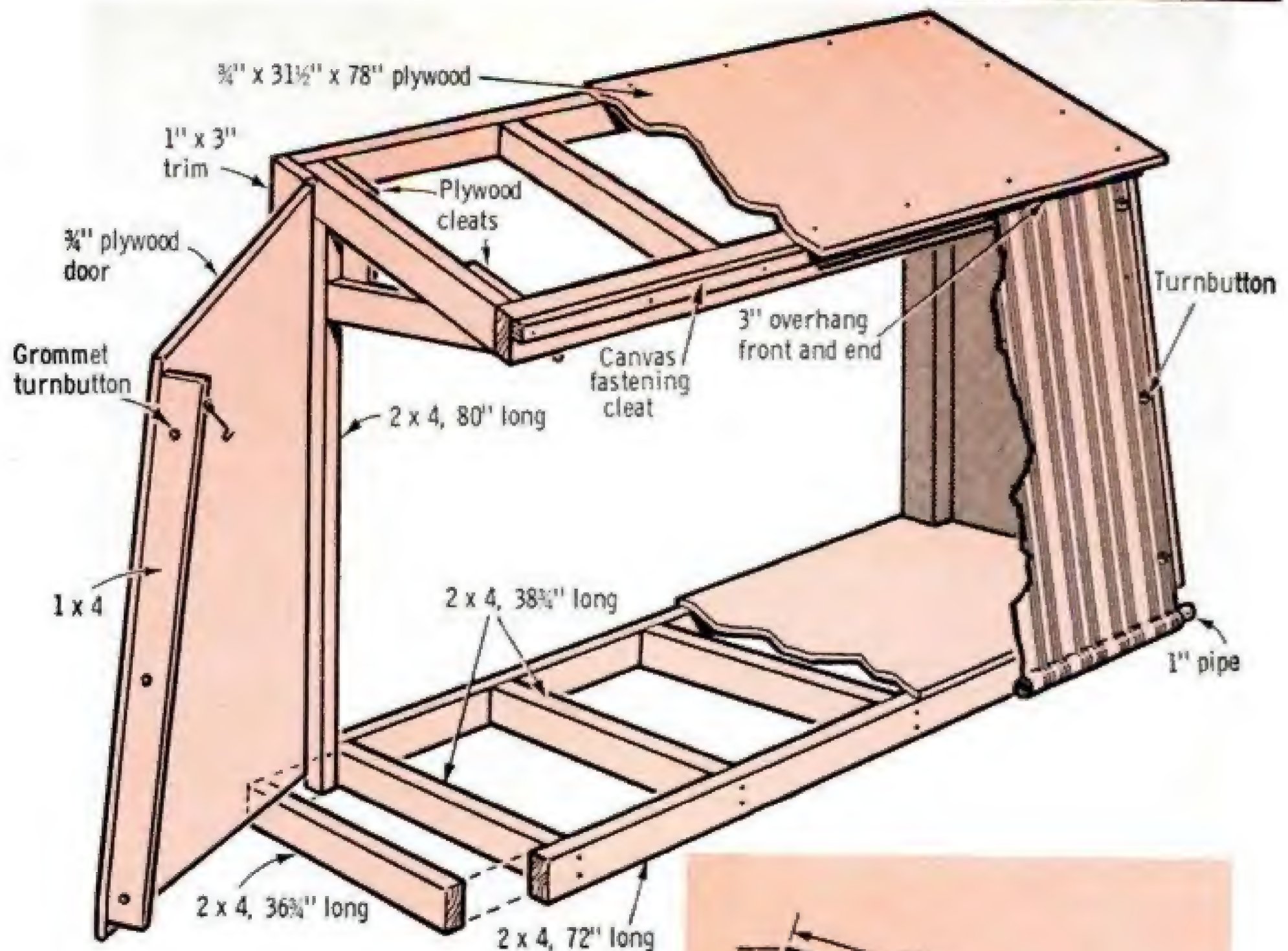
**CANVAS LEAN-TO.** Designed to attach to the side of a garage or house, this walk-in lean-to version, with its drop-curtain front, opens wide to give complete access. Canvas flap buttons to facing strips on doors







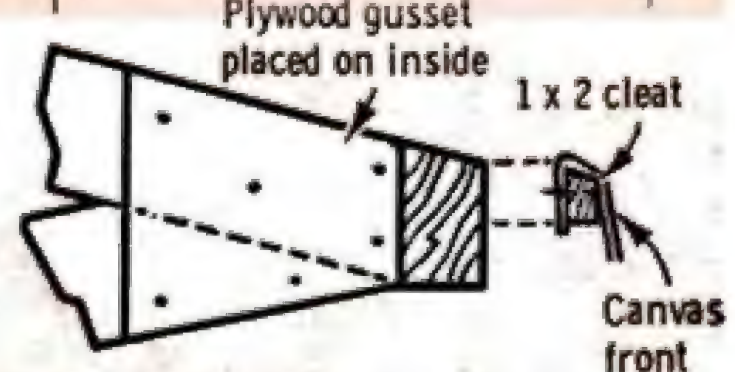
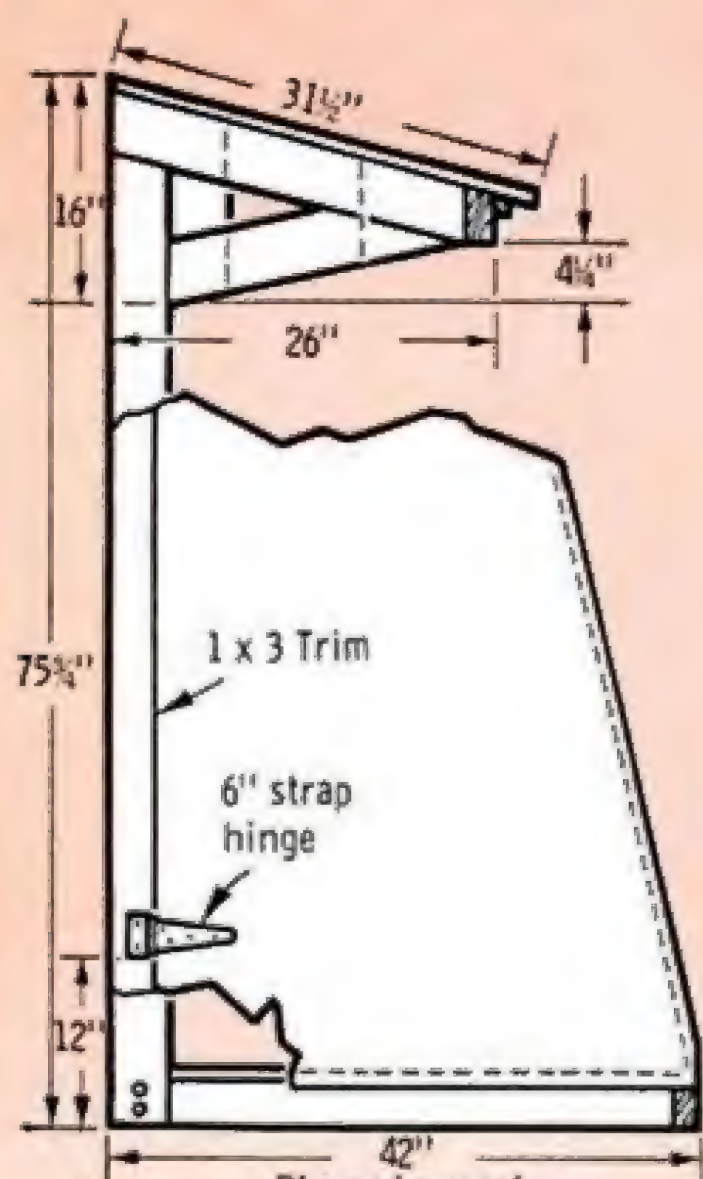




the lot makes for real convenience, too, when it comes to getting the machine out and putting it away.

Of course, any of these little shelters can be put to good use as mere utility buildings to care for garage overflow, or to take over where there is no garage at all. Ideal for out-of-season storage, they'll provide a place to keep folding patio furniture, screens and storms, kids' toys, snow shovels—you name it. Even to keep rakes and hoes handy to the garden, these little structures will prove extra convenient to have around. Handiest of all for this purpose is the canvas curtain lean-to. Here, in addition to being completely accessible from the front, both ends swing open wide. All it would take to make this one serve as a dandy garden toolshed would be a tool panel of perforated hardboard across the back and a shelf near the roof. And you'd still have room to park a rider mower or light-weight motorbike.

The motorbike hut pictured on the opening page and detailed on pages 186 and 187 was designed and built for us by







**SIDE PANELS** of 1/2-in Trentex plywood are attached to inner frames of 2 x 3 with flathead screws



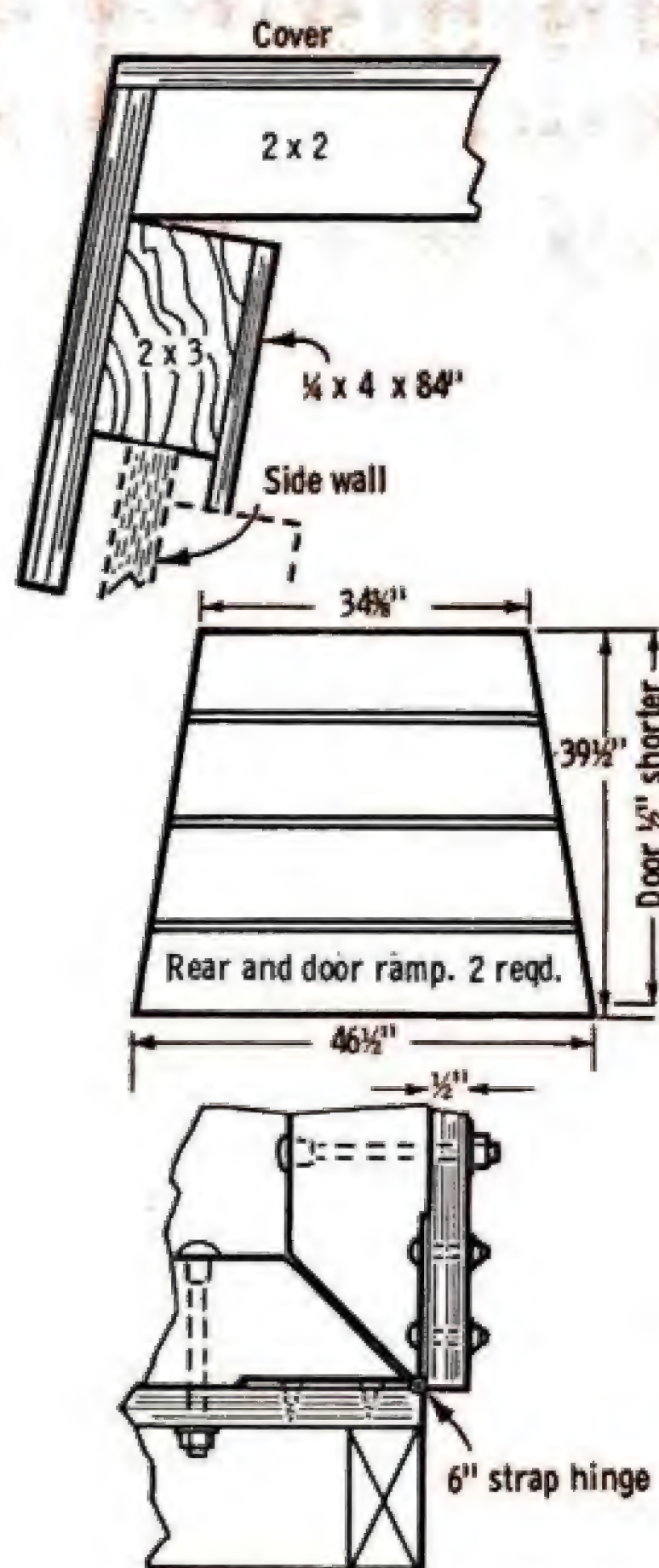
**WHEEL-GUIDE MEMBERS** are bolted to plywood platform with carriage bolts before wall panels are added

Potlatch Forests, Inc. of San Francisco.\* G. J. Geerlings, noted Connecticut architect, designed the others, and we had them built just to be sure they were right. You'll notice that two of the designs (the drive-through and the lean-to) permit you either to ride or wheel the vehicle in and out, each structure being fitted with doors and ramps at both ends. There's plenty of headroom in the canvas lean-to design to let you ride in, and in the drive-through design, the hinged roof opens up to provide the necessary head clearance. In the fourth design—the tractor barn—a portion of the roof folds back to let you ride right in, although here the vehicle must be backed out. If you want, you can hinge the ramps so they will swing up inside before you close the doors. In the case of the motorbike hut, the door doubles as a ramp and is held shut by the boxlike cover.

The basic framing of all four units consists of 2 x 3s and 2 x 4s, and, while plywood was used for the floors, doors and roofs, we also used redwood siding to relieve the plainness. Beveled redwood siding, applied horizontally, was used on the drive-through model; V-joint redwood, applied vertically, was used on the tractor barn. You could substitute hardboard siding, of course, as well as aluminum—

[\(Please turn to page 248\)](#)

\*A plan in folder form, complete with material list and instructions for building the motorbike hut, is available for 25 cents from Potlatch Forests, Inc., 320 Market Street, San Francisco, Calif. 94111



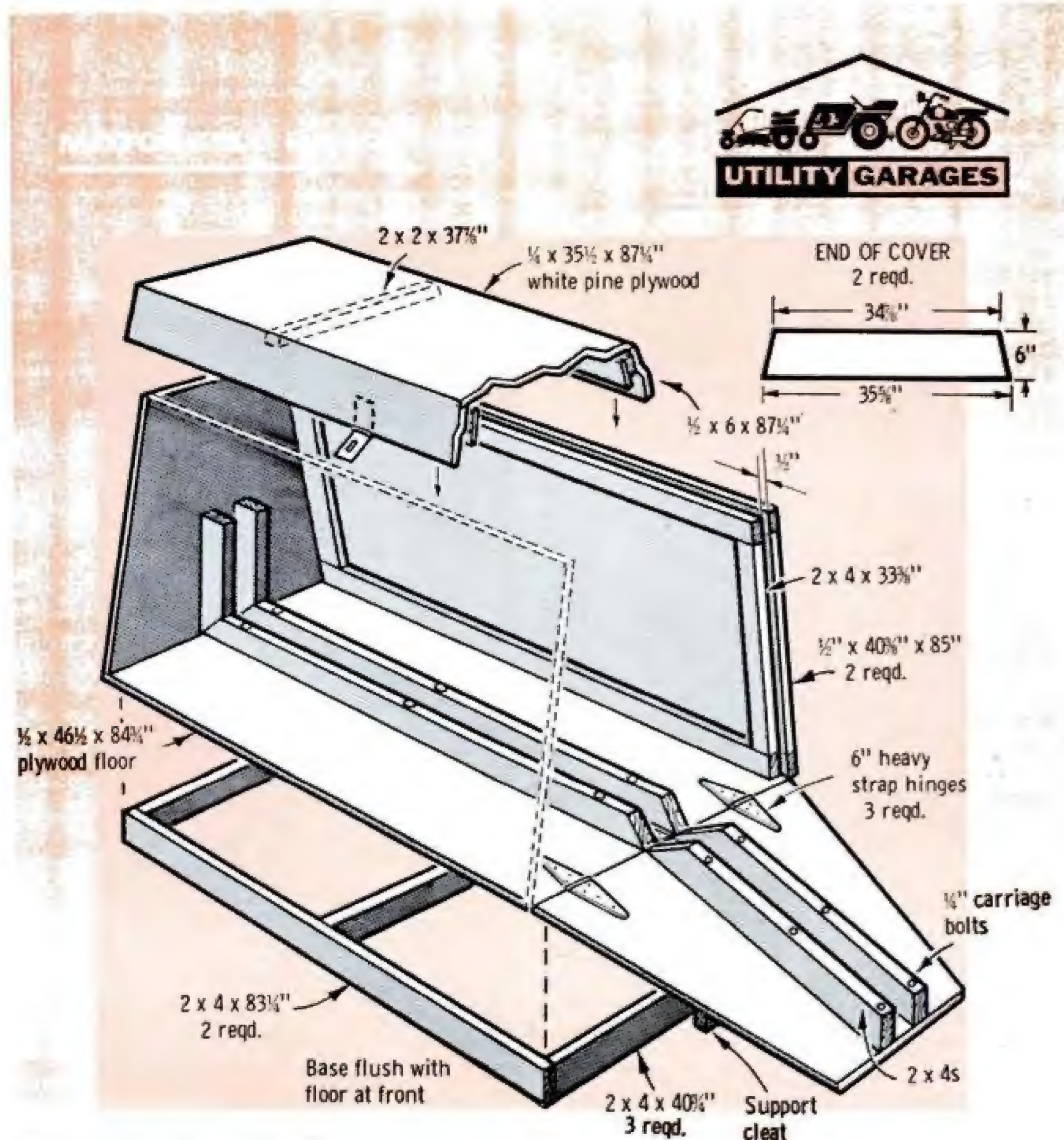




**STRAP HINGES** which support the drop-front ramp are attached to plywood with  $\frac{1}{8}$  x 1-in. stove bolts



**ROOF FITS OVER** tapered sides of hut like cover of a box and serves to hold hinged front shut without catch





# Homemade Spot Puts Glamour In Your Pictures

By Parry C. Yob

**P**HOTO PORTRAITS of your family and friends will take on a more flattering, glamorous quality when you pose your model under this professional-looking, fan-cooled focusing spotlight.

Start construction with the lamp carriage. Cut the angle-iron rod supports, clamp them face to face and drill the two outer  $\frac{1}{4}$ -in. holes the same distance from the edges. In the center of the rear support only, drill a  $\frac{5}{8}$ -in. hole. This is designed to pass the control rod.

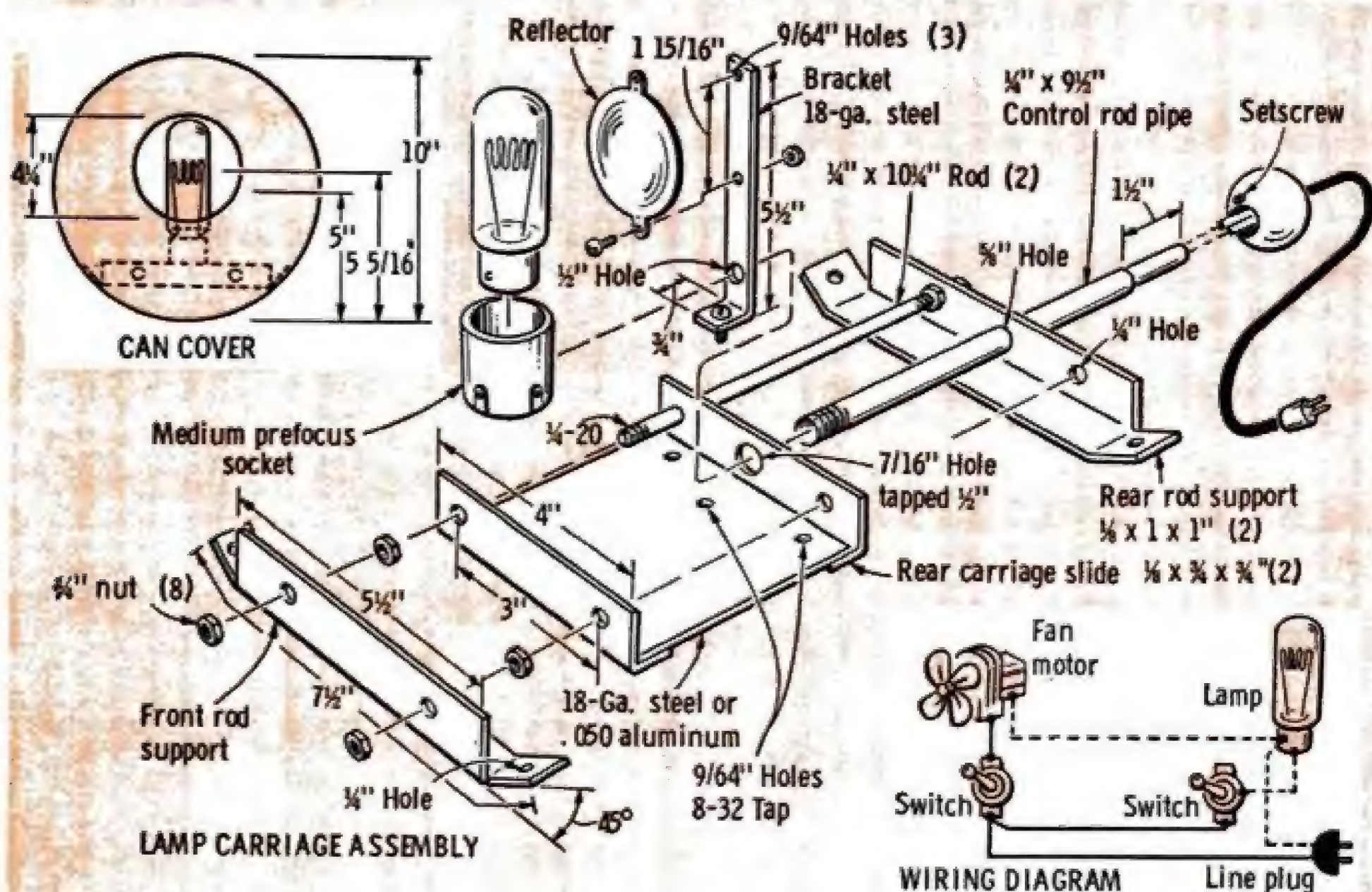
After cutting the carriage-slide angle irons, drill one of the outer  $\frac{1}{4}$ -in. holes in the rear slide. Run a  $\frac{1}{4}$ -in. bolt through it and the rear rod support, nesting the two, and drill the other outer hole. Then put a  $\frac{7}{16}$ -in. hole through the center and tap it for a standard pipe thread with a  $\frac{1}{2}$ -in. pipe tap. Repeat this operation for the front carriage slide, omitting the cen-



ter hole. Align the two slides first.

Drill the mounting holes in the rod support ears with a  $\frac{1}{4}$ -in. bit and bend the ears up, as shown, so as to fit the curvature of the tin-can housing.

Next, cut the carriage plate and cut and thread the two carriage rods for nuts. If you use tank float rod, you can salvage one already  $\frac{1}{4}$ -20 threaded end for each rod.









# PHOTO HINTS



**Forgot the ASA number?** Can't remember the filter factor? Then keep the data sheets handy in a simulated-leather pouch stitched to the camera's neck strap.

—Frank Fritz

**Save those frozen-food bags** and save your camera and film from heat damage in your car. Add a silica gel tin and close the bags tightly.—Ken Patterson



**No slip, no shake** with sponge-rubber pads under the tripod feet. Ideal on highly polished floors, the pads will also cut vibrations to the camera.—Ralph Claar



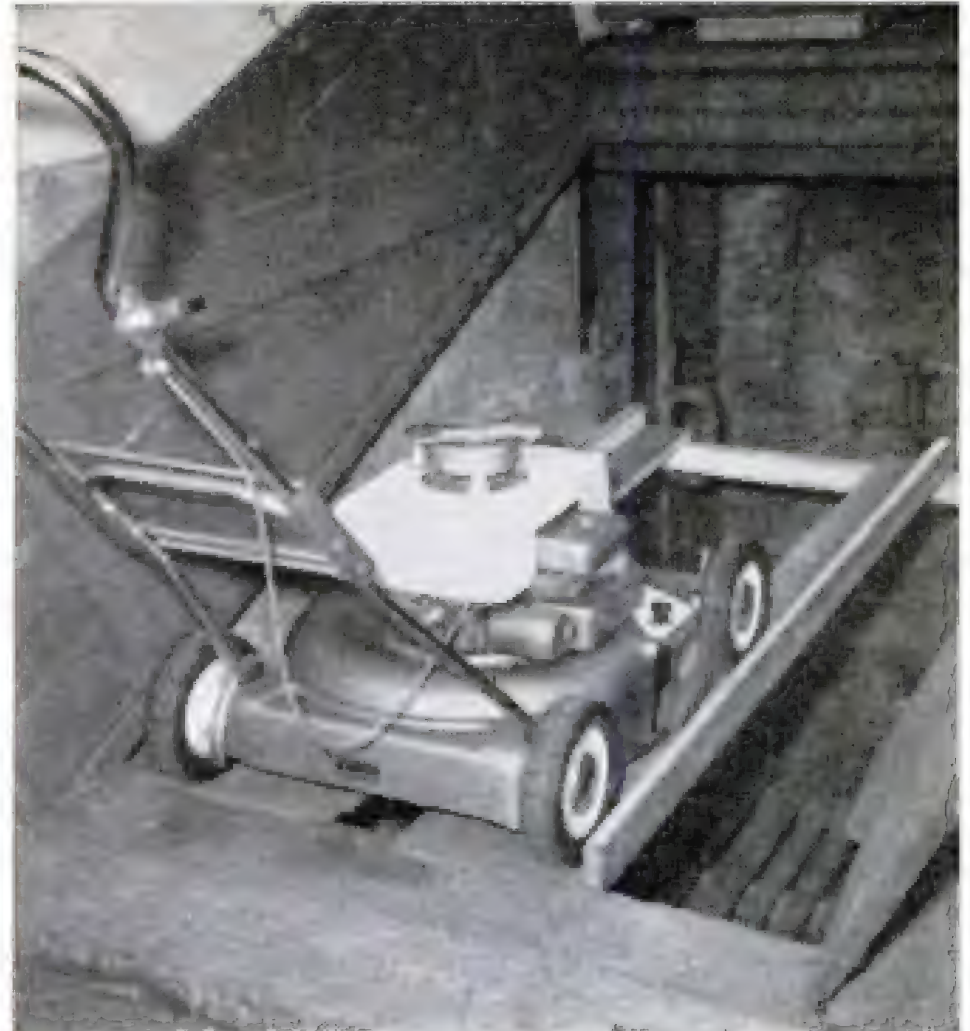
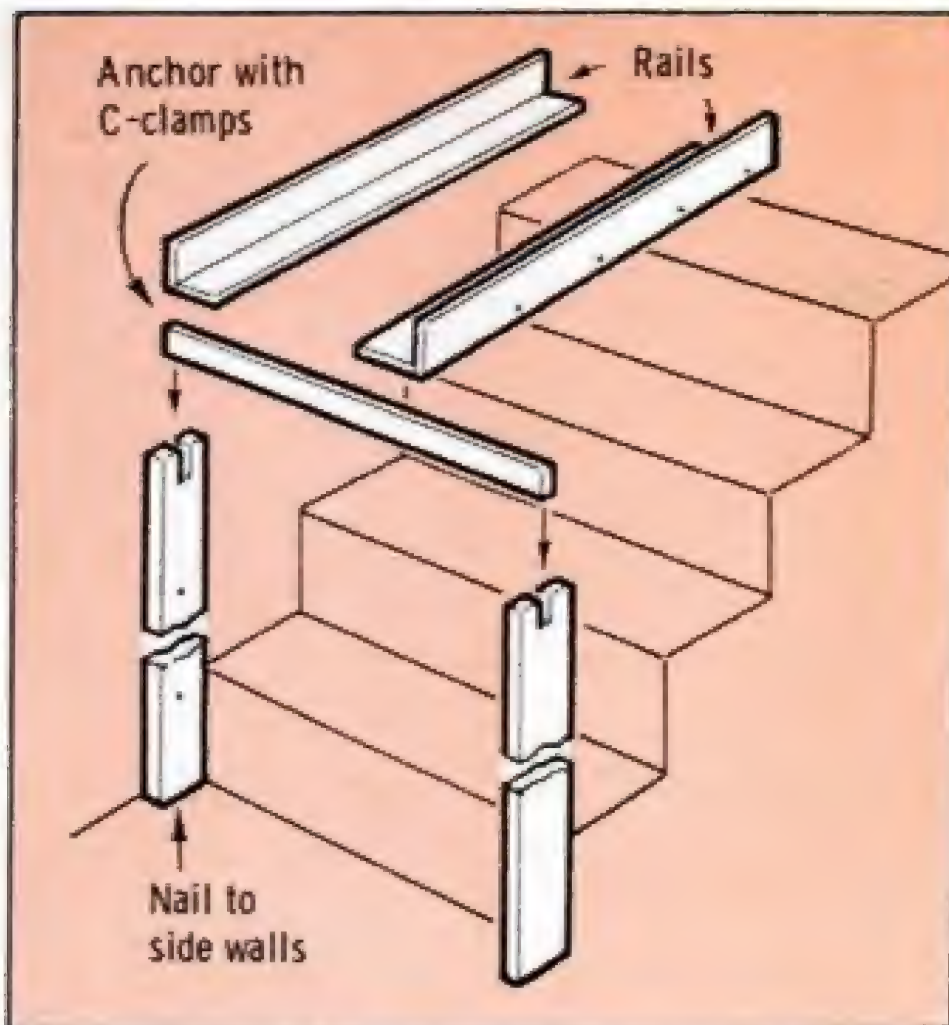
**Keep track of developer use** by pasting a calendar leaf on the bottle. Mark off each roll of film so you know when to discard the exhausted developer.—Ken Patterson



**Lost camera screws can be irritating** since you seldom have extras of this size in your toolbox. To prevent loss, tighten them and coat with clear nail polish.—Ken Patterson



# Service ramp for garden vehicles fits in cellar stairway



It's quite a trick to change the oil in a small rotary mower and even more difficult to service heavy-duty riding mowers, snow blowers or garden tractors. The problem is that you can't get under them to do what has to be done. Here's a simple project that lets you turn any outside cellar stairway into a temporary grease pit for servicing such equipment. It's basically just a couple of notched uprights which

are nailed to the walls of the stairway, plus a lift-out crossbar which is dropped into the notches to support the ends of two rails. C-clamps hold the rails the proper distance apart and also serve as safety stops. Dimensions and materials used will depend on the size of your stairway and your equipment, but be sure to use heavy enough lumber to provide sufficient support for the equipment.—William J. Paul

## NEXT MONTH IN SHOP AND CRAFTS

**TWIN TEEN-AGE BEDROOM.** There are two of everything (except the wardrobe closet) in this two-from-one bedroom which makes use of an accordion-door wall to temporarily divide one large room down the middle for homework privacy. Includes plans for building all furniture in duplicate—beds, tables, dresser-desks—plus the wardrobe closet

**CHRISTMAS TOYS FOR TYKES.** The yule season will be just around the corner when the December PM hits the newsstand, but you'll still have plenty of time to make any or all of these three pull toys in your workshop. A tiny train with magnets for couplings, a stacking cat and a pull-apart dachshund—they'll delight a toddler on Christmas morning

**PHONE TATTLES ON INTRUDERS.** Dubbed "Phone-a-larm" by its designer, this build-it-yourself electronics project is a silent sentry which watches over your home when you're away. If someone attempts to break in, this guardian robot quietly phones an alarm to any number you select. It's a project that could save you a big loss

**AUTOMATIC THERMOSTAT CONTROL.** To save fuel, you can turn down the thermostat when you retire and still wake up to a warm house with this automatic control. An alarm clock turns up the thermostat for you an hour or so before you crawl out of your warm bed. You can make this simple unit for one tenth of the cost of a commercial control





# Brand New Contractors' Trim Saw

By Howard Silken

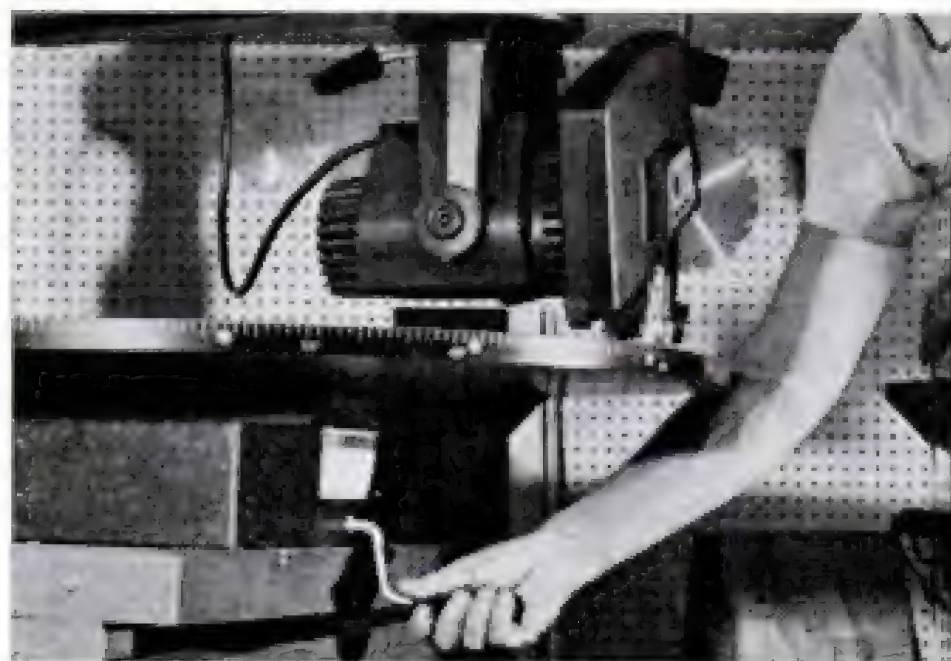
**W**HEN I FIRST LAID EYES on DeWalt's latest radial-arm saw, I knew the age of specialization had caught up with woodworking tools. True, we've already had radial arms designed for the home shop and others intended for industrial use, but the Model T-1810 is created especially for the building contractor—mainly to cut interior trim.

Pretty narrow market? Well, I suspect the manufacturer figures that once word gets around about this saw's special features, home workshopers may show some interest, too. The price—\$249 list—certainly isn't out of their range since it falls midway between the two radial-arm models that the same manufacturer offers the general consumer: the No. 1350 at

## ABOUT THE AUTHOR

Our guest tester, Howard Silken, could lay claim to the title "Mr. Radial-Arm Saw." He's been promoting this type of tool for a decade, through public demonstrations and his connection with Paul Silken Inc., a Manhattan sales agency for tools and hardware. Howard also teaches courses in the use of the saw which have been attended by over 3000, including many show business personalities. The courses gave rise to an illustrated manual entitled "How to Get the Most Out of a Radial-Arm Saw" (\$4.95 ppd. from Silken, P.O. Box 242, Oceanside, N. Y. 11572). Howard also markets several power-tool accessories on which he holds patents.

**SAFETY ADVANTAGE** from deep table is that even when blade is in extreme outboard position it can't contact arm as you crank for elevation adjustment







**EDGE SHAPING** is done with standard molding head projecting through notch at center of fence. Accessory guard at right was removed for photographs



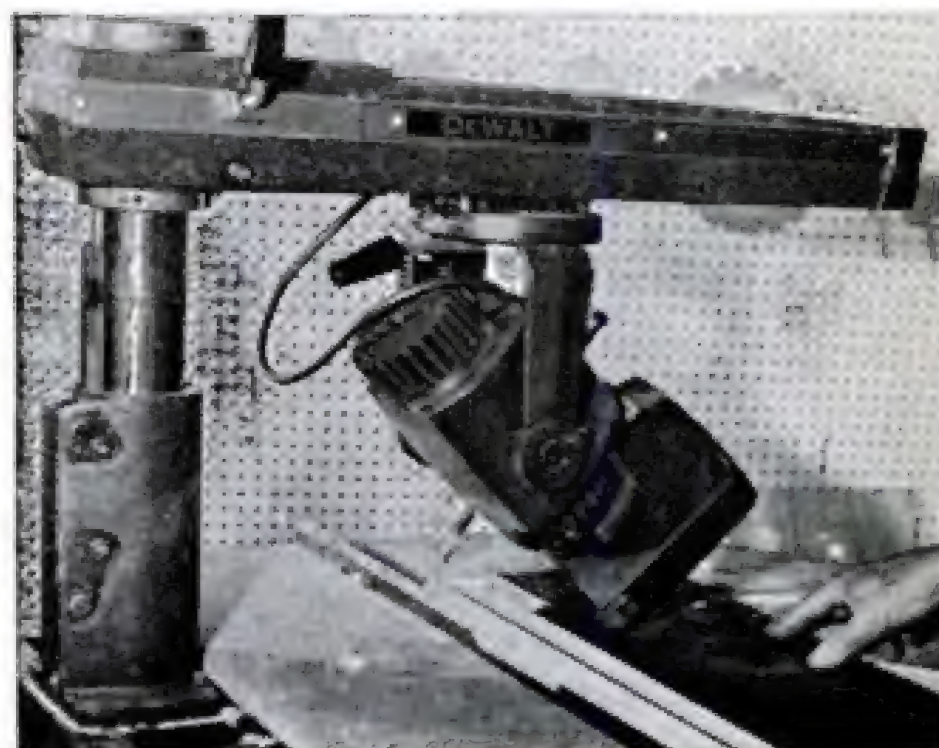
**TOP-GRAIN MOLDING** is best done in outboard position with molding head centered on rip trough. Feather board clamped to table holds work against fence

\$199 and the 1450S Deluxe at \$279.

What's this specialized saw offer that might tempt an amateur builder to ignore its professional label? Well, take a look at the table's rounded front and those two pivoting miter fences—and note that the table's offset to the left of the column so as to put the blade path down the center of the table. The disadvantages of this offset will affect ripping operations only, as shown in the photos below. For cross-cutting and mitering, I think you'll find it the handiest table you've ever used.

The deeper table assures you that the blade is never hanging over the edge, even in the extreme outboard position. Saws that do permit the blade to pass beyond their tables are considered so dangerous in some states that they are outlawed.

The size of the table would require a gorilla-reach to operate an elevating handle located at the top of the post, so the handle's been moved to the front of the table. It takes some getting used to, and



**SECOND PASS** can be made with work turned end-for-end and molding head (invisible because spinning) moved near fence for mirror image of first cut

some groping for, but once you've got your hand on it, this control crank lets you make precision depth adjustments as fine as  $\frac{1}{64}$  in.

The table's round front is really an expanded miter gauge. It's edged with a [\(Please turn to page 202\)](#)

**DISADVANTAGES OF TABLE**—since it's designed primarily for crosscutting—is limited support it offers to right of blade when ripping. Inboard ripping position (left photo) leaves only short fence to work against on in-feed side. Outboard position (right) makes ejection of long board a bit tricky, dragging hand under motor





# Microelectronics MAGNIFIED

Look over our shoulder  
as we take a  
microscopic peek  
into the mystery of  
microelectronics manufacturing

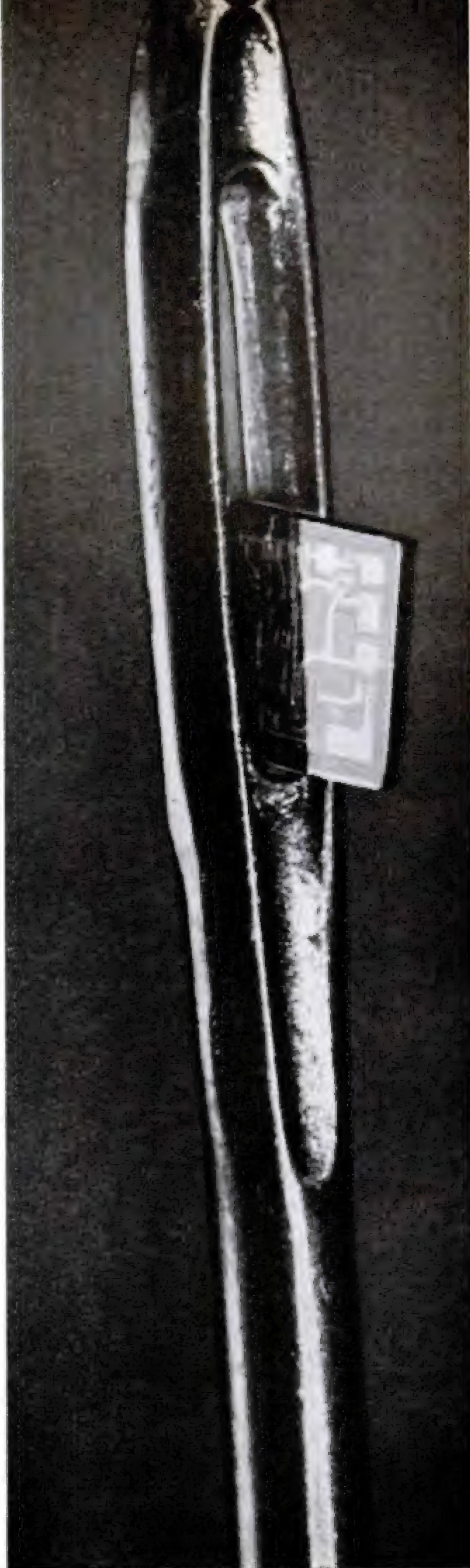
By Alexander Markovich

**T**HE MAGNIFICENT MEN of microelectronics start with a disc-shaped wafer the thickness of two hairs and about one inch in diameter and go on from there. The wafer is silicon, one of the most abundant elements on earth. Exploiting various chemical, physical and metallurgical laws, they put the wafer through well over 100 microscopic manufacturing steps—including, finally, the breaking up of the wafer into 400 or more identical chips tiny enough to flow through the finest-mesh kitchen sieve.

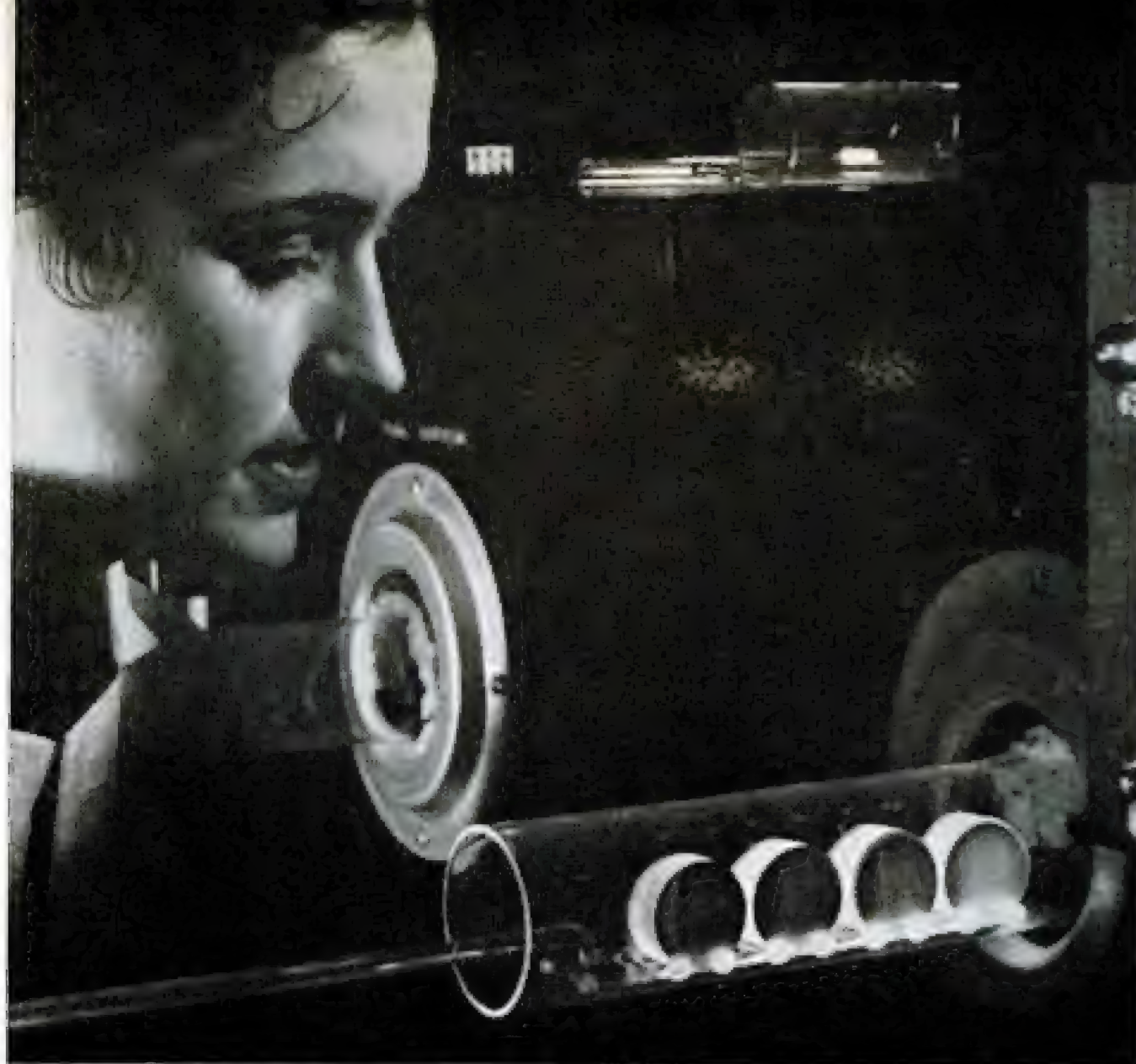
Each chip, measuring about 35 by 40 thousandths of an inch, is a complete and sophisticated electronic circuit.

The development of the microelectronic circuit actually is just one leap beyond the invention of the transistor. One manufacturer, General Electric, already has designed a portable and rechargeable radio incorporating the microcircuit. The

**EYE OF A NEEDLE** is big enough to pass a complete microcircuit, with room to spare for several more







**TRAY OF SILICON WAFERS** is slid into furnace at General Electric's microelectronics facility. The silicon oxide coating is applied to the wafer in this stage of processing. During this initial step, many chips are handled at once. Later, they're separated to undergo the etching and doping process

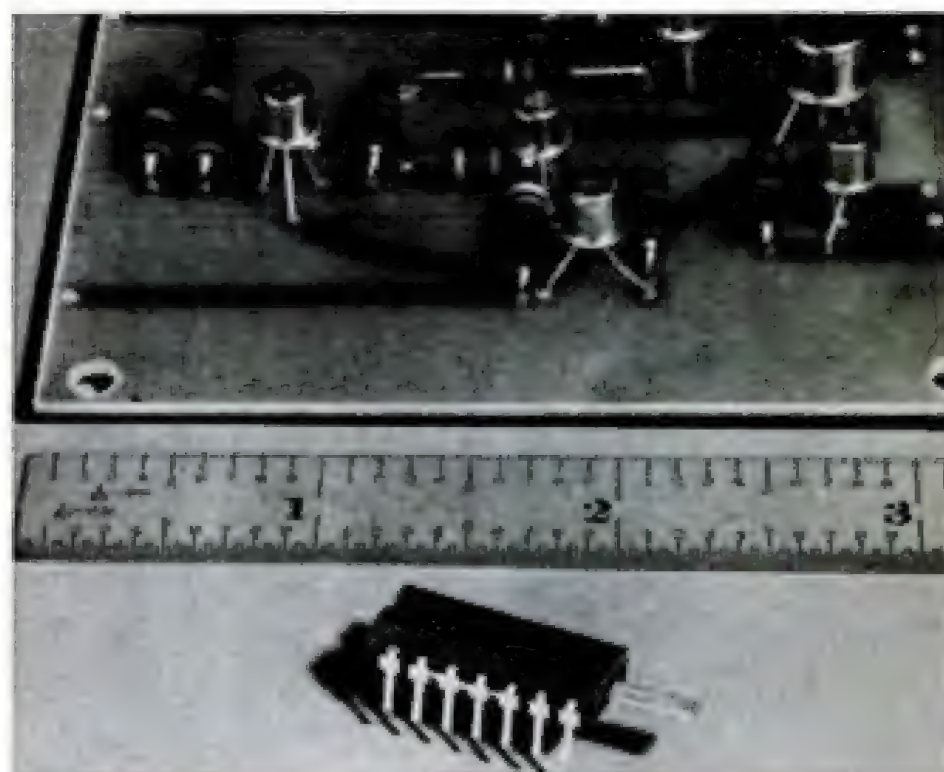


**MAGNIFIED VIEW** shows automatic probes checking circuit. Defective circuits are then removed from line

size of the radio, surprisingly, isn't noticeably reduced; speakers and several other radio components still can't be miniaturized successfully.

But the microcircuit offers many advantages, the most important one being reliability, chiefly through the elimination of soldered joints, a long-time bugaboo. And initial distortion in audio output is lower. Previously, it was impossible to match transistors exactly, but any two microcircuits from a single silicon wafer are identical. Lower distortion from temperature extremes, whether on the beach in the hot sun or perched on a snow bank in midwinter, is another expected benefit. What's more, current drain is lower, thus giving longer battery life. And eventually manufacturing cost is expected to be lower.

"After years of use, Uncle Sam is sold on microcircuits for aerospace programs. They have been used successfully in computers for the Gemini project and the Mars and Venus fly-bys. Component failure in conventional circuits has been a problem up to now because even if each individual part has a high percentage of reliability, the combined number of parts drags



**COMPLETED MICROCIRCUIT** is encased in silicone plastic. Leads protrude for connections; tab at right is heat sink; equivalent wired circuit is in back



**FIRST CONSUMER USE** of microelectronic circuitry is in GE's clock radio. Entire amplifying function in the radio takes place on a chip. Radio's detachable



down the odds. Here a single virtually failure-free circuit replaces a number of discrete components. And small size and weight are bonus advantages.

### 'Cigaret-pack' computer?

Meanwhile, back in the consumer area, the research and market study is going on hot and heavy. Perhaps soon the average consumer will be able to buy an inexpensive and reliable desktop computer the size of a pack of cigarets. So far, the limiting factor in the miniaturization of a computer is the keyboard necessary for feeding information. Some day the keyboard will probably be replaced by voice control.

"Subtle blend of science, craft and art"—that's how engineers describe the manufacture of microelectric circuits. The GE process is typical: The semiconductor junctions responsible for transistor amplification are created by forcing "impurities" into the silicon wafer in predetermined patterns. The impurities form the diffused areas shown in the cross-sectional drawing. These impurities, or doping agents, include compounds of boron, arsenic and phosphorus. Ironically, the so-called "impurities" are 99.999 percent pure. The dif-

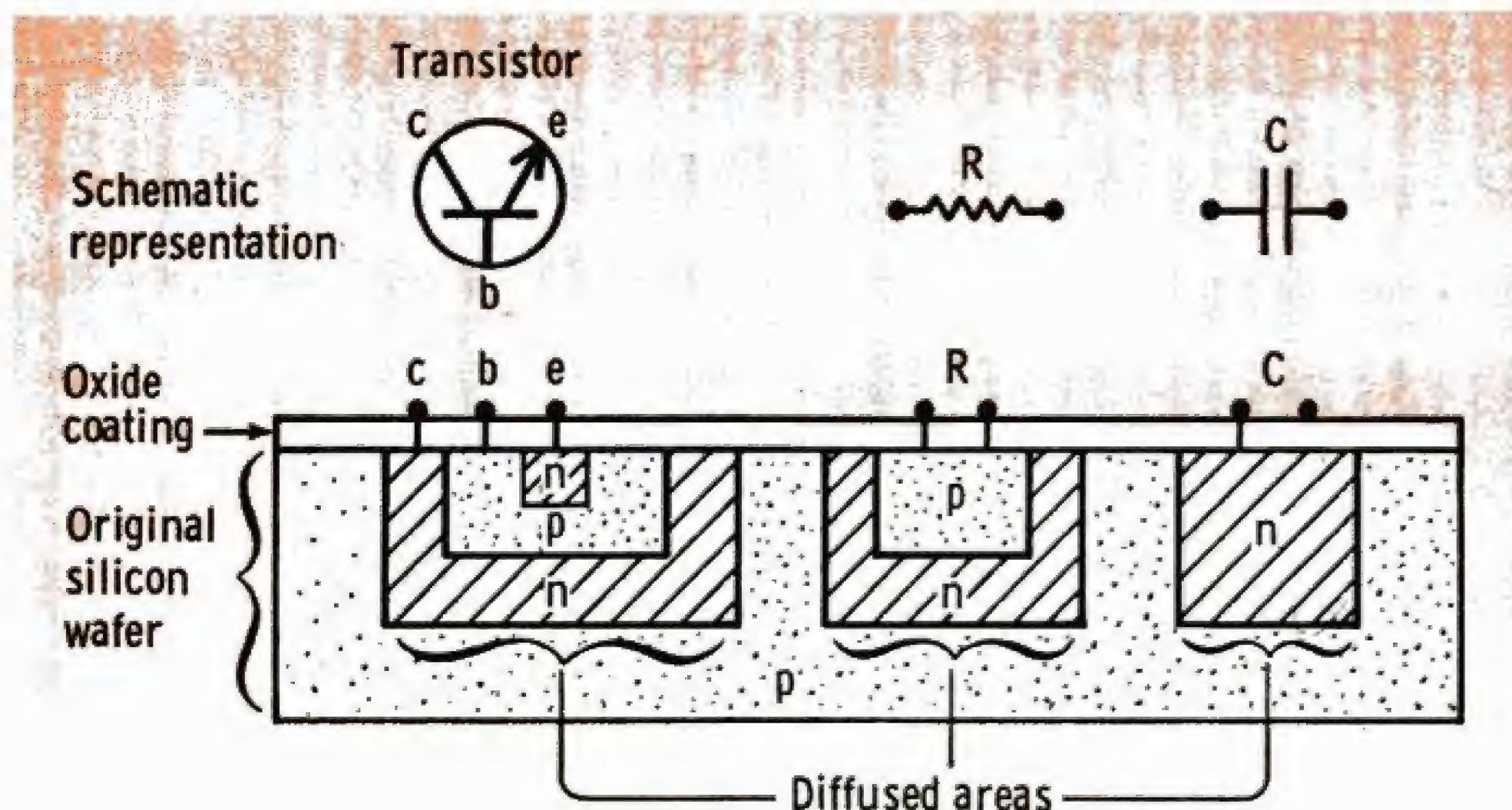
fused areas are still silicon, but of a different crystal structure.

Patterns for the doping agents are formed with high-precision photographic methods. First a silicon-oxide surface is baked onto the wafer in a 900-1200° C. (1652-2192° F.) oven. Then the wafer gets a  $\frac{1}{1000}$ -inch-thick whirl coating of plastic that is sensitive to light and impervious to acid. Next the pattern is contact-printed onto the light-sensitive plastic coating from high-resolution glass photoplates, or masks, using ultraviolet light, which "polymerizes," or hardens the plastic coating. Spraying on trichloroethylene developer washes away the unexposed areas of the plastic coating.

A solution containing hydrofluoric and nitric acids is then applied to etch the wafer wherever the acid-resistant plastic coating has been washed away. The acid solution is specially formulated to dissolve the silicon oxide surface but not the silicon underneath.

Now the wafer is ready to be diffused with the doping agents wherever the silicon has been exposed by the acid solution. The silicon oxide mask, however, is able to resist the fierce process temperatures of diffusion. This masking process

(Please turn to page 228)



**CUTAWAY VIEW OF MICROELECTRONIC CHIP** shows three circuit components—transistor, resistor and capacitor—diffused into silicon wafer. The original silicon wafer can be either "p" or "n" type silicon. The letters refer to the atomic structure of the silicon crystal. Alternate p and n areas are diffused into the crystal to form the circuit elements. The oxide coating carries the printed wiring between the elements and serves as a dielectric for the capacitor. The leads connecting the elements with surface wiring are also brought up through the oxide. Both resistor leads are shown connecting to "p" type area which provides the resistive path



# 20 Ways to Get More...



## Out of Your Tape Recorder

You can turn it into a teaching machine, make sound albums, preserve recipes—among many other things

By CHESTER H. LAWRENCE

**I**F YOUR TAPE RECORDER is just sitting in the closet gathering dust, you probably haven't discovered the many things you can do with it.

Of course, your recorder shouldn't be in the closet to begin with. If you own a tape deck or complete play-back recorder, it should, most usually, be housed with your other hi-fi equipment—always in a position to fire up with the flick of a switch. When it's easily accessible, you'll put it to better use. With a portable tape recorder, on the other hand, you have the advantage of being able to capture any sound anywhere you go. And you should keep that portable job in a place where it catches your eye and is always ready to go!

Here's a list—and an incomplete one at

that!—of 20 uses that will make your tape recorder one of the most frequently used audio components in your home. The majority can be realized with any tape recorder, but some will require a portable unit.

1. *Electronic family message center.* Set up the recorder in some convenient central spot—near the phone or in the kitchen is a good place. At any time of day Mom and Dad can record instructions, reminders, shopping lists, or what have you, for the rest of the family. During the day, anyone who is home can record phone messages, further instructions, reminders, etc. Incidentally, using a telephone pickup coil that fastens to the receiver is a handy way to record long distance calls for missing members of the family. (Of





**TAPING SOUND EFFECTS** for adding a "sound track" to your slide or film presentation, or for play-back during a round of party games puts your recorder to slick use. Sounds picked up with your portable cartridge recorder can even be duplicated on tape reels for your tape library and play-back on your home tape machine

course, to comply with Federal and local regulations for recording telephone conversations, you'll have to pick up a "beeper" to inject a 1000-cps beep into telephone lines and recorder every 15 seconds.)

2. *Automatic tutor.* Your child having trouble with the multiplication table? Record a practice tape for him or her. Record "two times one is," pause for about eight seconds, then dictate the correct answer "two." When using the tape, your child fills in the blank and directly thereafter gets the right answer to check. There are many ways to spark the learning process and this is a sure one. You might even try challenging a precocious child by mentioning that the tape speed is  $7\frac{1}{2}$  inches per second and 1250 feet of tape are on the reel; then ask how much playing time is left if you've already recorded 12 minutes!

3. *Duplicate tapes or discs.* Need an extra copy of a favorite recording? Make your own. Simplest way is to borrow a second recorder from a friend and record on one while playing back the old tape on the other. You can use the same

technique to save your rare old records. If those memory-filled old 78-rpm discs are getting noisy, keep those sounds from deteriorating further. Tape them now and start a tape library. Once they're down on the reel, you can even present a friend with the discs or sell them.

4. *Tape your own artists—live or broadcast.* Add to your music collection tapes of music performed by local artists, members of your family, their band or orchestra or your church choir. You'll be surprised how well they sound when played back through your hi-fi system. Of course, if you've got a stereo tape recorder, and two mikes, your tapes can be made in stereo.

Taping broadcast program material is an excellent way to preserve music or the spoken word that might otherwise be unobtainable or obtainable only by purchase of an expensive disc recording or prerecorded tape. Your FM tuner most likely has recorder output jacks, and good tape recorders and decks have line input jacks for recording directly from a program source.

5. *Tape sound pictures.* Try using your





**TAPING BUSINESS** at the office or business around the house puts your recorder to good use. Record notes on projects or troubleshooting tips for future use

recorder to make a record of representational sounds wherever you go. For example, you can make a sound picture of your home by collecting bits of typical events and sounds. Then edit them like a film to produce the greatest impact or to tell a story. An artistic production like *A Day in the Life of the Smiths* starting with the baby crying at 4 a. m. may rate you an academy award for comedy.

6. *Write letters on tape.* Next time you write friends or relatives send a "live" letter from the whole family. Of course they'll need a tape playback to "read" your letter. Be sure to indicate tape speed.

7. *Party games.* Tape sounds or sound effects and give a prize to the guest who identifies the largest number in this "What is It?" game.

Have one of your friends record half of a dialog on one track of a stereo tape. Fake in the other track and play it back; the results are quite amusing.

Record sounds at various points, places and spots in town. Airport, train station, Main Street and gas station are good examples. See who can identify the most locations from the sounds. It's fun and it

challenges the extent of your awareness.

8. *Tape lab and workshop notes and instructions.* Use a foot control switch to turn your recorder on and off while at work. Instead of making pencil notes of measurements and adjustments, make a sound recording. Later you can transcribe these to paper. This cuts time in doing a job by as much as 50 percent.

Any time you have complicated instructions to follow such as those for putting together a mechanical or electrical monster, tape the instructions. It's often easier to concentrate on your work and listen to directions than repeatedly turn to printed matter. Leave pauses long enough to permit you to follow the steps or fill the pauses with a little music to relax by.

9. *Add sound to home movies or slides.* Give your next showing of home movies or slides an added dimension. The simplest way is merely to record your commentary while monitoring the slides or film. Do this in a leisurely manner and carefully to get the greatest possible impact without appearing to have rehearsed.

For greater sophistication add music and sound effects where appropriate. The sound effects can come from sound-effect records or you can make your own.

To synchronize sound and slides, use one of the many devices intended for just this purpose—the Kodak Carousel Sound Synchronizer is a good example of such a device. With it you can record signals on tape that will key your slide projector and automatically change the slides at

[\(Please turn to page 214\)](#)



**PRESERVING CHERISHED RECIPES** or experimenting in the fine art of blending ingredients is assisted by the tape recorder; number of "pinches" is documented



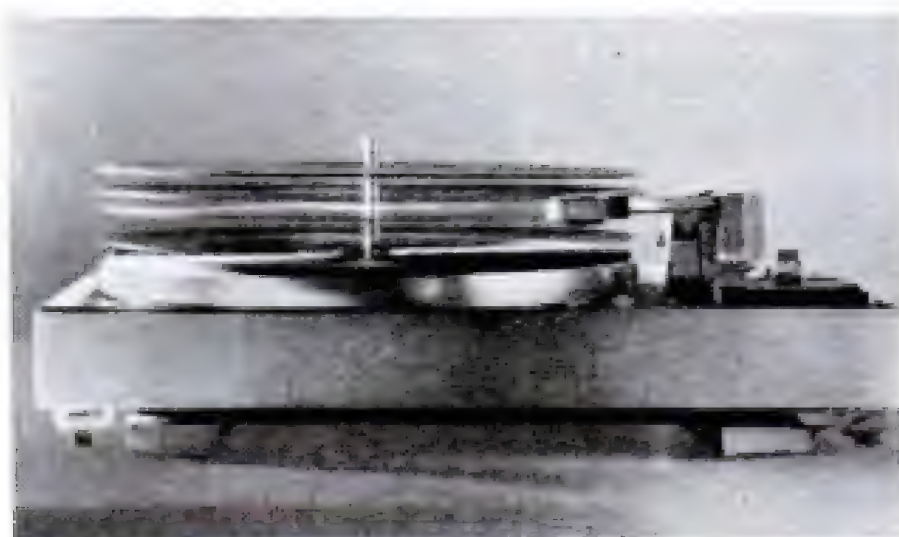
# new in HI-FI



**First-generation components** comprise complete stereo system from Sony. Components include turntable with 12-inch tone arm, solid-state integrated amplifier, 16-inch tone arm for transcription tables, power amplifier and moving coil cartridge.



**A line of speakers** in furniture enclosures is something new for Ampex. The models run from 15 to 75 watt capacity and from \$158 to \$420 a pair. The model 1115, above, has two mid-range units, an ultra-tweeter and a 10-in. woofer. Crossover points of the \$240 series are 2000 and 10,000 cps.



**Elevator action of new record changer** is shown in the multiple-exposure photograph. Record is *lowered* onto the stationary turntable that's part of Westinghouse Series 300 units. One motor operates the turntable; a second, the arm and elevator.





## A beautiful day to own a Volkswagen Station Wagon.

On Monday, January 24, 1966, an estimated 262,825,033.74 tons of snow fell upon the United States of America.

In Fraser, Colorado, a VW Station Wagon that stood for days out in temperatures of 25 below, started up without a tremble.

In Scarsdale, a lonely VW was blazing a trail to the commuter station.

In Albany, a VW took 8 angry neighbors down to the local service station for 8 sets of chains.

In Moline, a VW woman was first in line at the A&P Steak Sale.

Up in Boston, a group of college kids were finding out how many toboggans they could stuff into 170 cubic feet of VW space.

A Milwaukee junior hockey team showed up at the rink only to win by default.

On Monday, January 24, 1966, not too many VWs were sold in the U.S.A.

On Tuesday, things picked up.





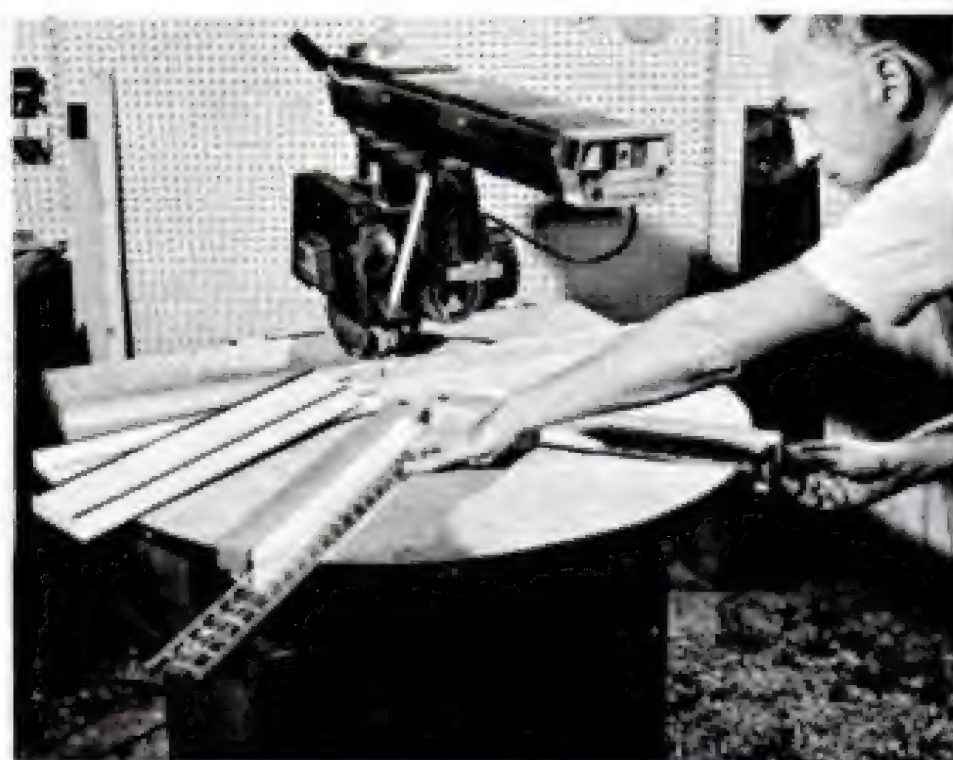
## TRIM SAW

(Continued from page 193)

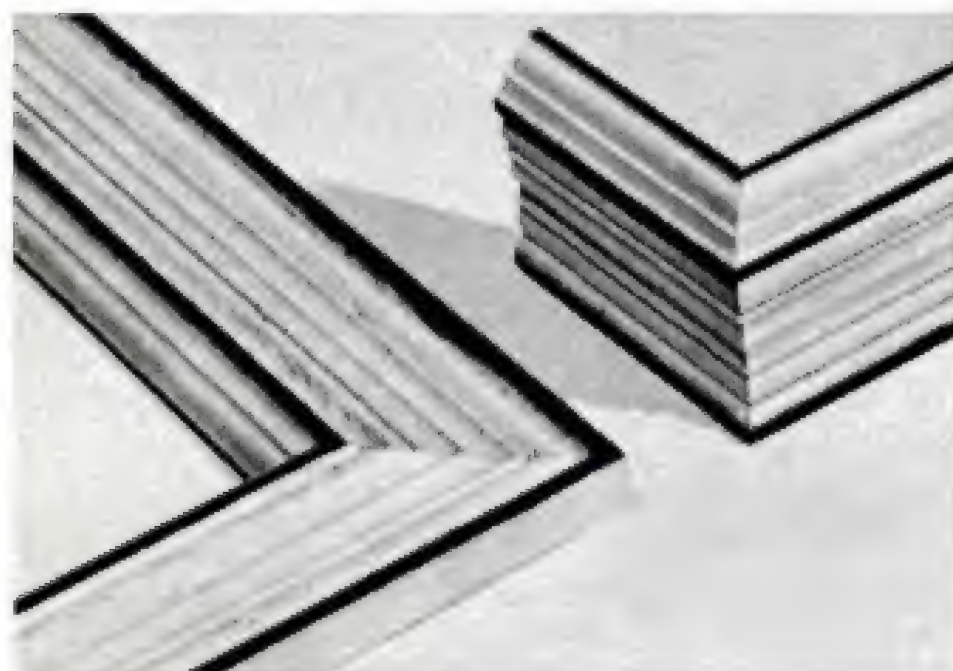


**PIVOTING MITER ARMS** are far enough from fence to permit straight cut without disturbing miter setting

sturdy band calibrated in degrees, with about  $\frac{1}{4}$ -in. space between each degree mark. The miter arms, mounted on the table, are precision-ground aluminum bars that pivot in sockets and lock against the gauge band. Each arm pivots from 0 to 90° right and left of the blade path.



**DON'T TRUST** edge scale for precise miters like those below. Set one arm and use square to position other



When the clamp knobs are loosened, the arms can be lifted off so the full table can be used for crosscutting or ripping large panels—or boards which are too wide to fit between fence and arms.

What's the necessity of all this? Isn't one function of a radial arm saw to cut angles by swinging the arm to the desired degree setting? Well, the truth of the matter is that—with any such saw—you'll get a more accurate miter by keeping the arm 90° to the fence and positioning the work at the required angle. This is particularly true when cutting molding for a critical job such as a picture frame. Without a jig, you have to swing the arm to the right to cut each left-hand miter, then swing it to the left for the right-hand cut. If the column gauge is off only 1° there will be an error of 8° in the assembly!

With the miter arms shown here, however, you can check the setting with a square to make certain they're an exact 90° to one another. Then you merely cut the right miter by holding the molding against the left arm and vice versa. With the arms square, the frame must be square, and you've saved time, lumber and aggravation.

An even greater advantage of these arms is that they let you *match* molding to a frame that isn't square. It's rare to find a door, window or built-in cabinet—even in new houses—that has truly square corners. In order to find the proper setting for the arms, you simply set an adjustable square against the frame, lock it, and hold the square against the miter arms while you set them to match. You don't even need to know what the angle is—the saw will cut the trim to a perfect fit. See now why it's called a contractor's saw?

The disadvantages of the offset table when it comes to ripping long boards can, of course, be overcome by improvising simple table extensions. And when it comes to edge-shaping, you needn't work with the molding head to the right of center. By angling the arm, you can bring the molding head to the middle of the table, to give you equal support for the work on either side. However, don't try this when you're doing top-grain molding, because the yoke locator pin must be kept up, and it's difficult to tell if your cutter is parallel to the fence. Make surface cuts, therefore, with the molding head directly over the normal blade path.

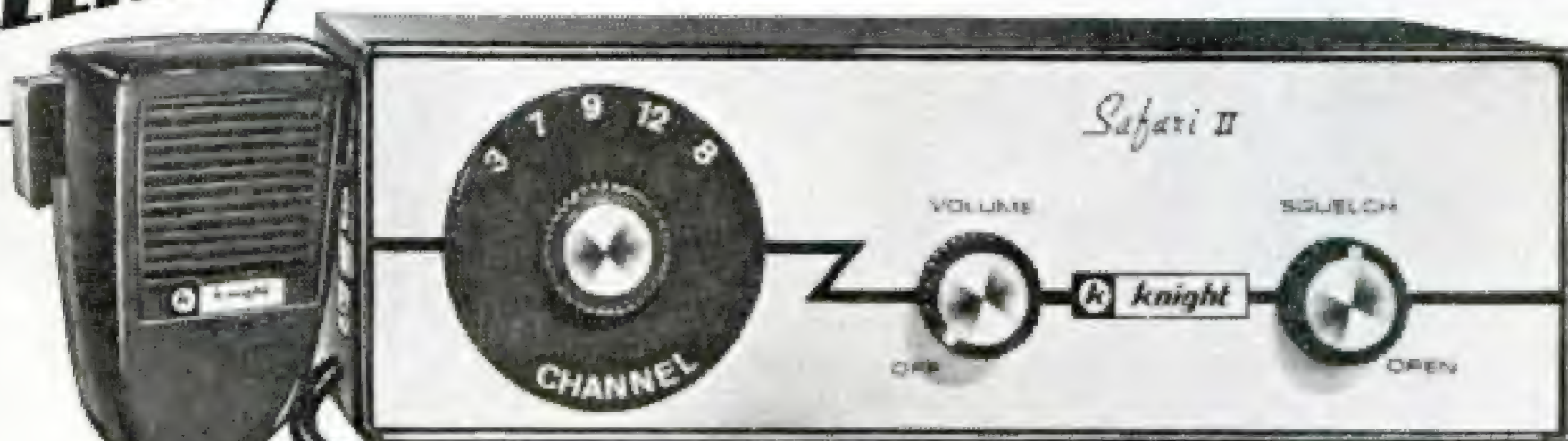
Incidentally, to shape the edge of the 1-in. board (top-left photo, page 193), I had to rest it on a scrap panel of  $\frac{1}{4}$ -in. plywood because the arbor nut that holds the molding head on prevented me from

[\(Please turn to page 206\)](#)



**NEW**  
FROM  
**ALLIED**

# **knight-kit® Safari® II & III** **Citizens Band Transceivers**

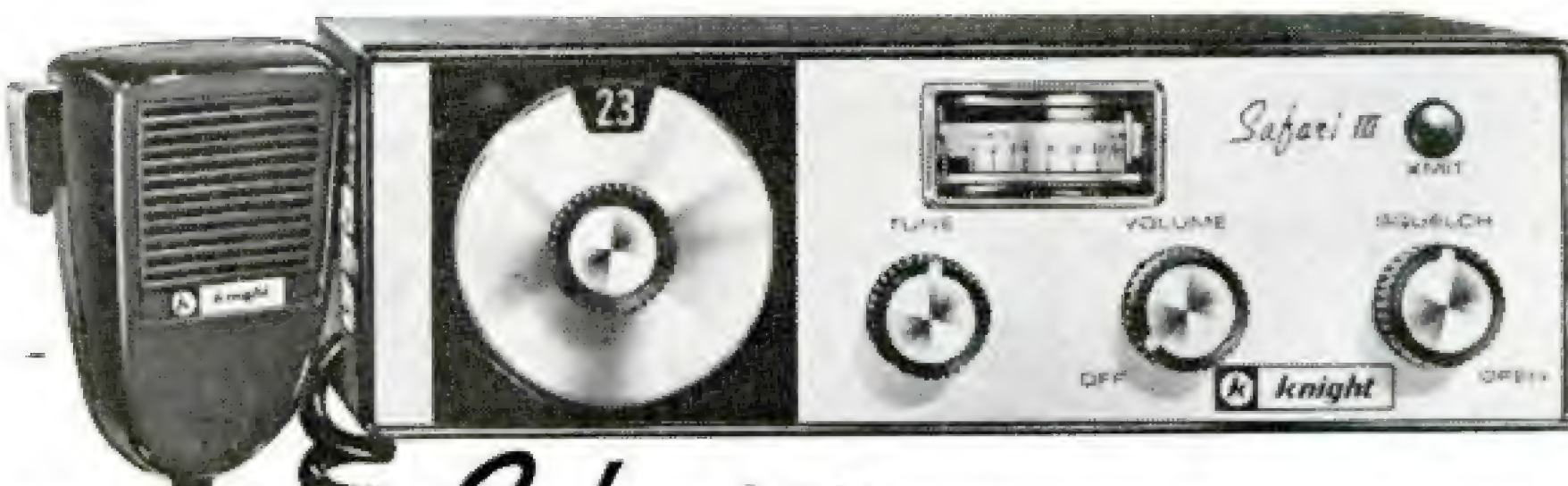


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***It had to be a McCulloch.***



## TRIM SAW

(Continued from page 202)

dropping the cutters low enough. A simpler solution for this problem would be to bore a "relief" hole through the table at this point for the nut to drop into.

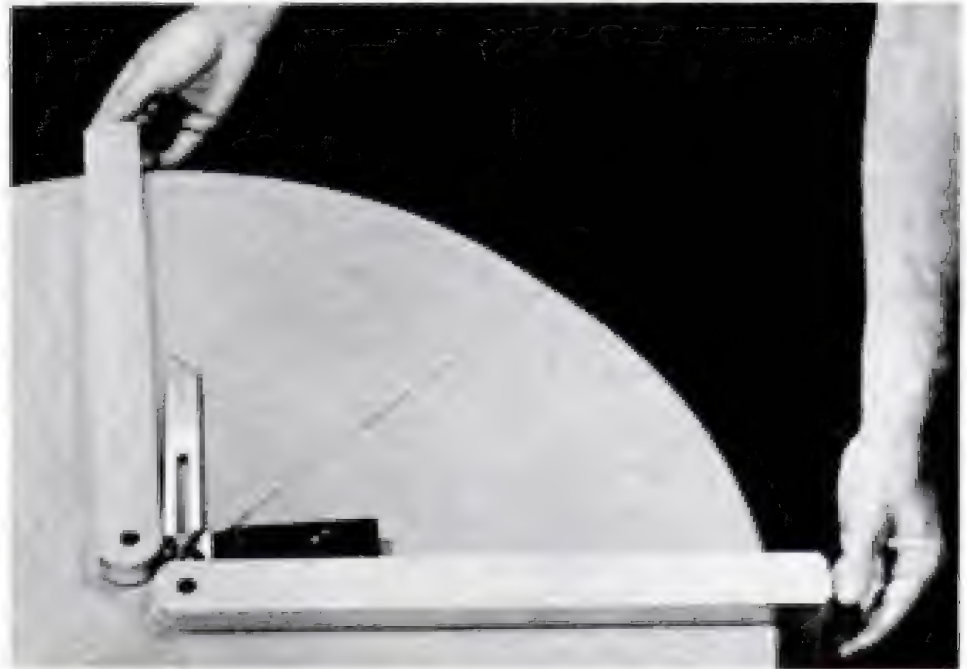
The saw comes with a 10-in. combination blade that gives a 3-in. depth of cut. The motor is a "true" one-horse, and this industrial rating shouldn't be confused with the higher "developed" horsepower ratings often given home workshop mod-

els. This saw has most of the features a quality radial-arm model should have, such as full kerf adjustments, "take-ups" to keep all metal-to-metal wear points snug, a cast-iron arm, and four ball bearings in the head that can be adjusted for drag—and a built-in motor brake.

Most of my dealings are with home craftsmen, and from my familiarity with their problems, I'd say this new tool should be considered right along with the more conventional models by anyone in the market for a radial-arm saw. ★★★



**NO DOOR IS PLUMB**, but you can take the angle directly off the frame with adjustable square (left) and transfer this setting to saw's miter arms (below)



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**I didn't believe Andy when he insisted the new Remington Model 1100 automatic had less "kick" than any other shotgun going. So we bet on it. He won.**

Andy really knew what he was talking about.

He let me try his 12-gauge Remington Model 1100, and I could have sworn I was shooting a 20! All the power is there. But Remington's new system of gas operation handles recoil so efficiently I hardly felt it.

Best of all, I was able to get off faster, more accurate second shots. With less "kick," the 1100 didn't "climb" and throw me off target.

And the balance was so right, it let the 1100 point and swing as if it were part of my arm.

Then Andy really opened my eyes with the inside story of how the 1100

is built to last longer than other automatics. He explained that the receiver is machined from a solid block of ordnance steel. Key parts are beefed up for greater strength. Working surfaces are highly polished to reduce friction. And points of greatest impact get special buffer "cushions". No wonder the 1100 lasts longer!

Same dependability holds true for the outside, too. The custom-checked American walnut stock is protected by Du Pont RK-W "bowling-pin" finish—toughest ever put on a gun. And the highly polished metal finish is extra rust-resistant.


I have my own Model 1100 now.

Holds up to five shots, handles all 2¾-inch loads (even baby magnums) without adjustment. Mine is a 12-gauge, but you can get a 16 or 20, too. All standard chokes and barrels. Plus trap, skeet and magnum models, and the new deer model with rifle sights.

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**What a difference a name makes**

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# SUNKEN TREASURE

*(Continued from page 127)*

established" on the bottom in three different places from the Keys to the coast north of Cocoa, Fla. She has never been found, but the significant thing is that every location reported is close ashore on the shoals.

It's unlikely that even an old pro like Slack will spot cannon or anchors from the surface, as witness my experience. They are usually so encrusted with coral that you can't make them out or they've sunk deep into the bottom silt. The best indication is usually ballast rock.

## **Ballast outlines hull**

Ballast is the rock the old seamen used to weight the keel of their ships to keep them upright. When you come across a wreck, the ballast rock sometimes forms an outline of the ship's hull along the bottom. But you've got to make sure it's ballast rock and not just a pile of coral.

According to Jack Slack there are two ways to do this. Either bring up a piece to the surface and see what it weighs (coral is much lighter than rock) or take a geologist's pick down with you and give the rock a tap or two. Coral will crumble; ballast won't.

Toughest part of the job comes next. You work the bottom. And how you do this is very important. If the wreck is in shallow water, and most of them are, you go down to the bottom and have air fed to you through a scuba regulator from an air compressor. This will permit you to stay down for long periods, eliminating bulky scuba tanks and gear.

"In warm waters—Florida or the Bahamas," Slack explains, "you probably won't find any wood parts of the ship left. They'll have been eaten away by teredo shipworms and rotted. But under the ballast you should find an anchor and cannon. If you don't, chances are the wreck has already been salvaged. But even so, you may still find a worthwhile artifact or two."

Moving ballast is a tough job, but filtering through the sand and mud for treasure below it is worse. A handy tool here is an air lift. It's a kind of giant vacuum cleaner. You can make one from a 10-foot length of 4 or 5-inch-diameter plastic pipe. At the lower end, about four inches up one side, make a hole for a pipe from your air compressor. Now when air is fed through that hole it rises up through the pipe carrying water with it. The flowing water will lift the muck off the bottom and blow it away.

If possible, you should screen what

comes out the air lift or you may miss coins or other small valuables. A single doubloon and necklace in a recent find brought more than \$4000.

I had often wondered about the value of metal detectors in this business and asked Slack about them. He snorted, "Most of them are worthless. I've tried many commercial detectors and can promise you that unless the wreck involves a large bulk of metal close to the surface, the detector won't find it. But there is one electronic device that does work—a proton magnetometer. Trouble is it costs a fortune, and in shallow water where you want it most, it has a very narrow search area.

One obvious problem for a dedicated treasure hunter is the same one that faced claim stakers in the Yukon—poachers, sometimes with meanness and guns.

By the time a working day is done, the treasure hunter must mark the location of his find so he can spot it quickly the next morning. Trouble is most markers are also visible to the poacher.

Jack Slack has a couple of tricky ways to handle this. "You can use an underwater buoy," he says. "Take a hunk of foam plastic or an empty plastic bleach bottle, tie on a short length of fiberglass line and weight. Drop it right on the wreck—or say 50 feet due north of it. When you get back out the next morning it shouldn't be too hard to find. "Of course," he points out "other skin divers in the area will be able to find it too."

## **How to fool them**

To fix these fellows, he makes concentric circles of scrap on the bottom at 50-foot intervals from the wreck. They don't really look like circles to the eye, so no one else will find them. But the man who does the marking knows what he's looking for.

Actually, Slack, who is a real pro in the business, has an even better system. He reads the bottom—takes a mental picture of landmarks that he will never forget. Few amateurs are able to do it.

Having marked the site, gone back to port, had a good night's sleep, kept their mouths shut about what they found and gone back to work the next morning, the hunters will get the air lift going and examine *everything* they uncover. A lump of coral may conceal a mass of silver pieces of eight, an old drinking glass or a jeweled necklace. Maybe a gold doubloon if they're lucky. The only way to be sure there is nothing in the chunks of endless coral is with an X-ray machine

*(Please turn to page 212)*



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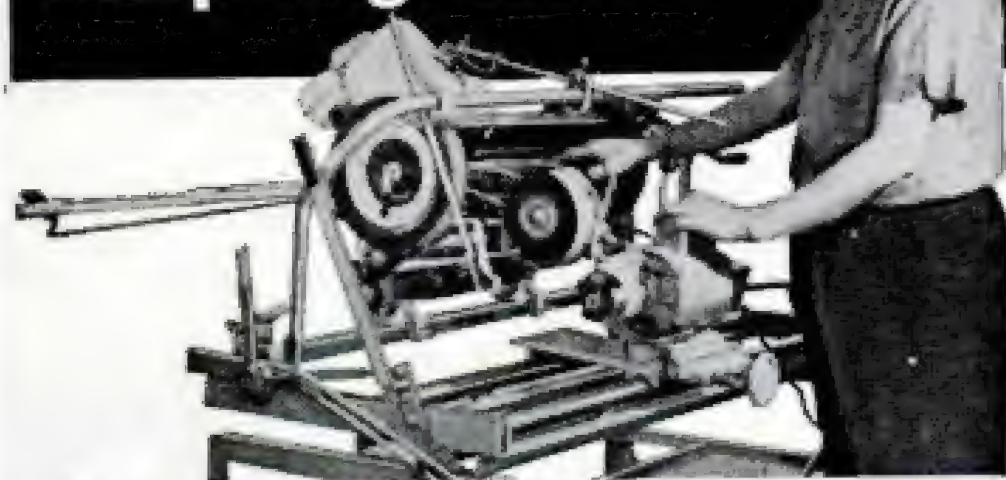
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## SUNKEN TREASURE

(Continued from page 211C)

or by careful chipping. Once uncovered, the treasure must be raised, brought ashore and sold. This is where the trouble really starts.

"It's not the selling, it's the keeping," Slack sighs. "You must have a license and a legal contract with the state government to operate in the first place (Florida and the Bahamas). And it is vital to have a binding agreement with your partner or partners before you even start looking. It must specify what procedures you will follow to dispose of anything you do find."

For example let's say that you and a buddy spend a day on the bottom and come up with a pewter mug. You say it's worth \$200. Your "friend" says \$100. Your agreement should be set up so that you can buy your partner's share for \$50 (what he says it's worth). Or he can buy your share for \$100 (half of what you say it's worth). If neither one of you can raise the purchase price (which often happens) you attempt to sell the item—first at the highest price (\$200) for a predetermined time (60 days is good). If the cup has not been sold, the price is reduced to the next lowest figure, and so on—depending upon how many partners there are.

There you have it—the treasure finding game and its rules. Whether you are a weekend searcher, vacation time hunter or a full-time pro, the tips in this story should boost your chances of striking it rich at the bottom of the sea. ★ ★ ★

## Splat cooling

A process for creating new metallic alloys holding great promise in such fields as electronics and computers is now under development by the U.S. Navy's Office of Naval Research.

Informally called "splat cooling," the method consists of blasting a molten droplet of a pure metal or alloy against the rim of a refrigerated metal wheel spinning at a high speed. The droplet is then cooled in the form of a piece of thin foil at an extremely high rate—so fast that the atoms do not have time to realign themselves in their usual patterns.

As a result of the very high cooling rate, crystalline alloys not otherwise obtainable can be synthesized. Production is now limited to small bits of thin foil, but future application, although only speculative, could lead to the discovery of new electrical and magnetic properties and the synthesis of superconducting compounds.



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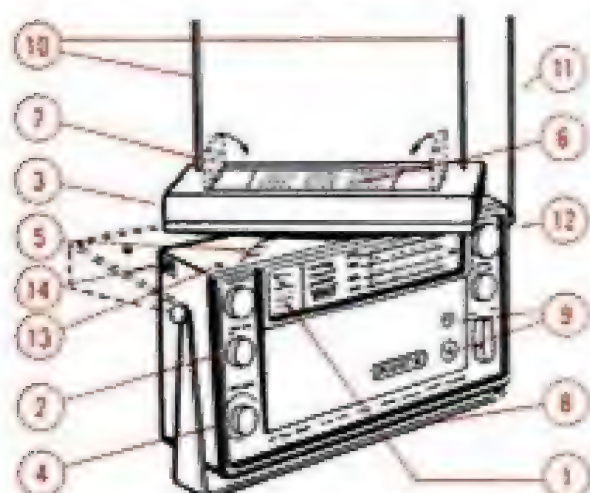
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- VHF** 108-136 MC All General Aviation communications. Hear planes in flight, airport control towers, professional pilots, private planes.
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5. 100° LEFT-RIGHT BEARING SCALE gives accuracy of 10° diameter compass rose even though set is only 2½" thick.

6. MORSE CODE, a handy guide to help identify beacon signals.
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11. LONG RANGE EXTENDABLE REMOVABLE WHIP provides maximum signal input on ground.
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## YOUR TAPE RECORDER

(Continued from page 199)

the appropriate points in the narration.

For movies, the simplest method is to make sure that your sound background doesn't have sharp transitions. Fade the sound in and out between scenes allowing a few seconds of leeway so if sync isn't exact it doesn't matter.

10. *Play rehearsals.* You have a starring role in a play, but you have trouble learning your part. Read the play through with someone else to cue you. Record the cues on one track, your role on the other. You can then leave the cues on the one track and do your part over and over again until you have it down the way you want it.

11. *Hunt the vanishing sound.* Every generation has a different sound, and every year some sounds disappear—that of the steam locomotives, for example. Sound hunting can be very exciting. Use a battery powered recorder or a standard recorder with an inverter so it can be powered by your car battery. A long microphone cable is the only other special piece of equipment you will require to make the recordings.

12. *Family record.* A running sound record of family events can be even more exciting, when played back in future years, than the pictures you take with your camera. Start with a recording of your wedding (if it's not too late), go on to the baby's first words. Make candid tapes of birthdays, Christmas and New Year's parties and vacation trips. Commentary edited onto the tape polishes what will become a very valuable document.

13. *Tape your recipes.* Undoubtedly you have some special dishes which require ingredients in quantities that are not exactly prescription doses. To preserve these or to pass them on to your children, let the recorder run as you mix, measure and stir, giving full details of each step. Transcribe this to regular written form or simply use the tapes as a recipe.

14. *Exotic sound collection.* Tape the odd, strange and exotic sounds you run into in your travels. For that matter, a collection of all the sounds you hear can be exciting and useful when you want to add sound effects to your favorite home movies or slides.

15. *Record bedtime stories.* Going out

for the evening? Prerecord a bedtime story or two the night before. Your babysitter can play it back before putting the kids to bed. (Or play it back yourself when you've got laryngitis!)

16. *Record guest speakers.* Having a prominent speaker at your next club meeting? Tape his talk. Your local radio or TV station may wish to use excerpts, or even the entire speech in its news report. Also, a library of taped talks can be a valuable fill-in for a program when you can't get a speaker for appearing.

17. *Tape the world around us.* During spring and summer, set up your recorder on the porch, patio or out in the yard. Play a record on your hi-fi system. Use one that has prominent parts for the flute. You'll soon have birds from blocks around join the orchestra. Some will mimic the flute, and some will fall flat on their faces trying to keep up. An ordinary omnidirectional microphone that will pick up both the music and the birds is best. Also in this category is the whole realm of nature study—whether pursued professionally or as an amateur. "Hunting" with a microphone can be fun.

18. *Sound mirror.* During your next family gathering hide a microphone in the living room and record the goings on during the get-together. Play it back later so all can listen back as observers to their own vocal antics.

19. *Problem solution bank.* Every once in a while your wife will call you at the office to find out how to change a blown fuse, or what to do to get the whatchamacallit working. You might even have your share of temperamental gadgets that are easy to get back into operation if you know how. Why not tape the troubleshooting instructions for these so your wife can get the solution at the "tape library."

20. *Compose electronic music.* The tape machine has proved a boon to modern composers. You could do some spoofing or quite seriously get in on the new school of abstract music which is composed by manipulating and combining all sorts of sound. Use your tape recorder to produce and edit the sounds you use. Tones or natural sounds can be broken down, slowed down or speeded up by changing tape speeds or turning the recorder on for brief instants. If you're interested, listen to some samples of electronic music on records or from a broadcast and take it from there! ★★ ★



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*Smooth, quiet luxury — 6 hp Fisherman with full gearshift.*



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*Folding Lightwin stows in a carrying case.*



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*Standard Yachtwin has high-thrust drive.*



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# 25 year history of U.S. Savings Bonds



**1941:** FDR buys first E Bond.



**1944:** June 6—D Day.



**1945:** The war ends. Bond sales continue.



**1948:** Berlin Airlift.



**1950:** President Truman orders military aid to Korea.



**1951:** Kefauver hearings. E Bonds get 10-year extension.



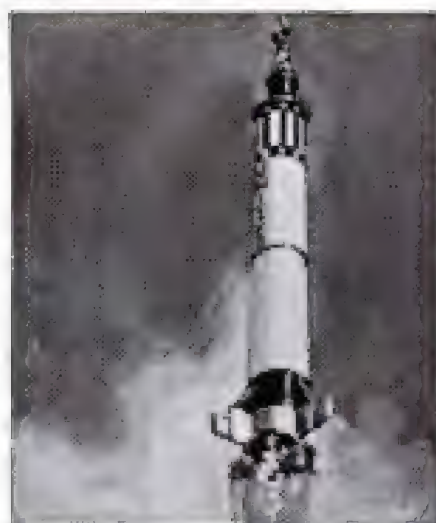
**1953:** Dr. Salk develops polio vaccine.



**1956:** Don Larsen hurls first perfect Series game.



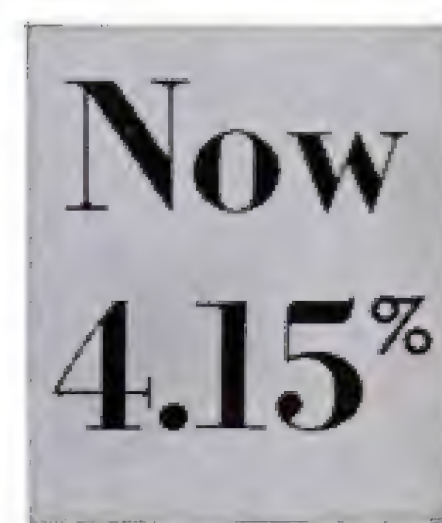
**1959:** St. Lawrence Seaway opens. \$17 billion in E Bonds over 10 years old.



**1961:** Alan Shepard is first U. S. Astronaut in space.



**1963:** John F. Kennedy assassinated; Lyndon Johnson sworn in.



**1966:** Savings Bonds' 25th Anniversary. New 4.15% interest rate announced.

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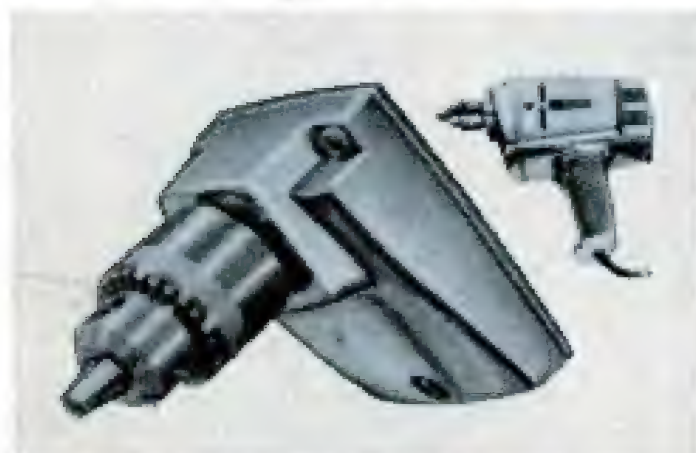
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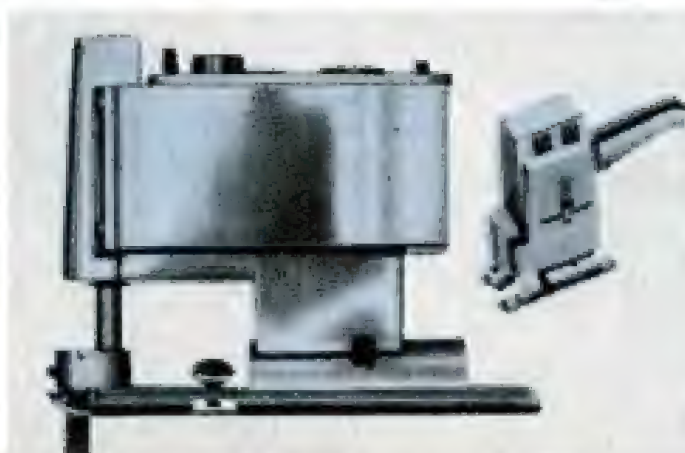
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## MICROELECTRONICS MAGNIFIED

*(Continued from page 196)*

is so accurate that it can form transistor-line widths of one ten-thousandth of an inch.

A radio microcircuit requires eight matching sequential photographic plates, one for each of the diffusions forming ohmic contacts, interconnections and other functions.

### **Lilliputian system of measures**

Tolerances in masking and fabrication are so small that engineers speak in terms of microns instead of inches. One ten-thousandth of an inch, for example, is equal to 2.54 microns.

To hold mask positioning to within one-micron tolerances, as is routinely done at GE, requires white-room conditions where temperature and humidity are rigidly controlled. All personnel in the room wear nylon or Dacron coveralls and caps, and rubber finger covers to keep acid in the skin from contaminating the work. Electrostatic precipitators filter out all dust particles larger than three microns. Air pressure in the room is kept slightly higher than normal so dust isn't drawn in when the door is opened.

Despite these controls, this isn't clean enough. The masks are aligned under special hoods equipped with additional air filters. Since human hands are far too dirty and shaky in this dimensional region, tremor-free mechanical manipulators and stainless-steel and plastic vacuum probes shift the silicon wafers into proper position against the masks. The coated wafers are sensitive to ultra-violet light, so the room is illuminated with an eerie gold lighting.

The various circuit functions are diffused into the wafer in layers, forming a three-dimensional network. In reference to depth, our system of measures shifts gears again. The silicon oxide surface layer, for example, measures 2000 angstroms thick rather than two tenths of a micron.

### **Picking out the bad ones**

Defective circuits, which result from mask pinholes too small to be detected, cause short circuits and poor junctions. But they never get past an automatic probing machine. Operating in a darkened room because the silicon junctions are light-sensitive, the probe automatically tests each circuit in the wafer through a nest of silicon carbide needle points, each with a tip finer than that of a darning needle. Up to 20 contacts to the aluminum connections of the circuit are made

simultaneously at the rate of five circuits a second.

When a circuit is found defective, a solenoid-driven marking plunger darts into the probe nest and marks the circuit with magnetic ink.

### **The high cost of handwork**

Incidentally, only about a quarter of the manufacturing cost is represented by the circuits while they are still a part of a wafer.

In the early manufacturing stages, batches of 20 to 100 wafers at a time can be processed in the diffusion furnaces and in other operations. But then diamond scribes scratch each wafer surface into rectangles and, thus, a wafer is broken into hundreds of chips, or individual circuits.

From then on, automation is largely replaced by skilled handwork, and manufacturing cost shoots up.

Resembling glittering coal dust, the chips are then spread over a conveyor belt that passes beneath a series of magnets. Most of the defective units, marked with magnetic ink, are pulled out in this operation, but occasionally a bad one isn't caught. A technician, looking through a microscope, sifts through the good chips with a hand-held magnetic probe, searching for the one in a hundred defective chips that slips through.

Now the chip is hand-soldered to a copper heat sink, and gold wires half a thousandth to two thousandths of an inch thick are bonded to circuit connecting pads about 3.5 thousandths of an inch square. These gold leads are then welded to a copper frame, and the circuit is transfer-molded in a dense, void-free silicone plastic at greater than 400 p.s.i. pressure.

The circuit then goes through a final performance test. Of 126 separate manufacturing steps through which the circuits pass at GE, a quarter of them are quality-control inspections.

### **Penetrating the cost barrier**

Today, microelectric circuits are still more expensive than conventional transistorized circuits, but manufacturers are working overtime to bring costs down. One way would be to replace skilled handwork with largely automatic machines. But this is an all too obvious way to reduce cost. The really important cost breakthroughs are undoubtedly being sought in closed laboratories by research scientists armed with microscopes and more imagination than you can shake a chip at. ★ ★ ★





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### Elderly are anxious learners

Part of what has been termed a "learning deficit" in elderly people is not reduced capacity to learn, but slowness to respond under pressure, says Dr. Carl Eisdorfer, assistant director of the Duke Center for the Study of Aging and Human Development.

Older people are more anxious than the young when faced with the necessity of learning something, yet their anxiety inhibits their speed of performance, according to Dr. Eisdorfer. However, when the pressure is off, the elderly learn as well as the younger people.

The Duke scientist compared the speed of word recall in two groups, divided by age. He flashed words on a screen and then gave his subjects four seconds to respond. As expected, youth scored higher. But when the older subjects were given 10 seconds to respond, their scores increased dramatically. The initial low

scores were not caused by mistakes, but a failure to respond at all.

He also measured physiological responses and discovered a correlation between the test situation and body functions. The level of free fatty acids in the bloodstream—an index of anxiety—followed a different pattern in the old than in the young. Heart rates were also affected.

### Sun, moon affect satellites

Changes in the orbits of the earth's satellites are affected not only by the earth's shape, but also by the sun and the moon.

According to Drs. James P. Murphy and Theodore L. Felsentreger of NASA's Goddard Space Flight Center, both theoretical and experimental studies show the effects of solar and lunar forces. They have calculated a computer program for analyzing the motions of such far out satellites as Relay 1 and Telstar 2.



# THE FASTEST TRAIN

(Continued from page 92)

could conform to the track-hugging contours of from one to five permanently coupled intermediate coaches. A single pair of wheels would support adjacent car ends, eliminating sawing and saving tons of independent truck weight.

If this sounds like a broken phonograph record, it is, to the extent that articulated cars are as old as Grandpa's trolley-and-trailer sets. But in the best of previous designs—the Spanish *Talgos* and the Chesapeake & Ohio's *Train X*—the coaches rode piggyback, one on the wheeled posterior of the next. That way, the axles were never at right angles to the track on curves. So the flanges tried to climb the inside rail and, failing, backed off and belted it again and again. It didn't make for creature comfort.

## Axle between cars

The answer to that, the design team knew, would be to place the axle *between* the car ends and, with drag links, hold it midway between them, whichever way they angled.

Next, there was suspension and springing. Again they could dip into an old bag of tricks. In the late '30s, three "pendulum cars" had caused quite a stir when they were given a try by the Burlington, Great Northern and Northern Pacific. Clusters of giant coil springs rose from their four-wheel trucks almost to roof height.

When supported at that level, the coach bodies banked inward when centrifugal force exerted its tug on curves. The arrangement took up a lot of space. But it produced a remarkably fine ride, and might have gotten somewhere if World War II hadn't diverted attention to a freight-car shortage. Anyway, with the TMT's sparing use of wheels, and air springs replacing coils, the one known disadvantage could be canceled out.

Or could it? General Motors had used "windbags" on a flyweight flyer called *The Explorer*. Instead of soaking up road shocks, they had converted them into a bobbing motion which made passengers reach for Dramamine pills. So a large scale model was built and tested at the research laboratories. It seemed that the air springs had to be placed at a very critical height above a train's center of gravity.

## Lighter, stronger bodies

Finally came the task of designing extremely light car bodies which would meet or better the collision-insurance

standards required of railroad equipment. This was no more than a routine exercise for the blue-up-yonder engineers. The major contribution would be honeycombs of deep but thin-walled "I" beams and bulkheads to take the place of the single ponderous center sills of conventional coaches. They'd be covered with sheets of heavy-gauge aluminum, curved to offer greater strength and eliminate wind drag.

TMT thinking and plans had reached this stage when the U.S. Department of Commerce, under authority of the High Speed Ground Transportation Act, began shopping for two trains with which to conduct one of several traffic studies in the Northeast Corridor.

The United Aircraft offering was chosen for a Boston-Providence project, on tracks of the New Haven Railroad. The tab for the two-year lease comes to \$2.1 million, with U.A. maintaining the equipment and providing an ample supply of spare parts.

There is a curious parallel and an unanswered question here. Thirty-two years ago, another two-headed, three-car, articulated streamliner built by an aircraft manufacturer flashed over the New Haven's Boston-Providence route. The Goodyear-Zeppelin Corp. was the U.A. of that day; everybody liked the train and said it just went to show what an outsider could do for a tired old industry. By-and-by there were more passengers than seats. Then the brass hats complained, because they couldn't hang additional cars on the front, back or middle of the danged *Comet*. So they pulled it out of service and settled for a locomotive, lots of standard cars, slower schedules and, eventually, few passengers.

Do United Aircraft engineers have an answer for that?

## Couple trains for bigger unit

Recently I dropped in at the Corporate Systems Center and asked them. They led me to a handsome model of a TMT and told me to touch either of the bulbous nose sections. I did, and it popped open like a clamshell, revealing a coupler and electric connections for the operation of two or more train sets as a single unit. That's the way the Canadian National is going to put them over the iron between Montreal and Toronto. Fourteen cars with coach and deluxe service for 680 passengers. Weight: 600,000 pounds empty. A comparable train of the kind now in service—13 cars and three Diesel units—weighs 2,300,000 pounds.

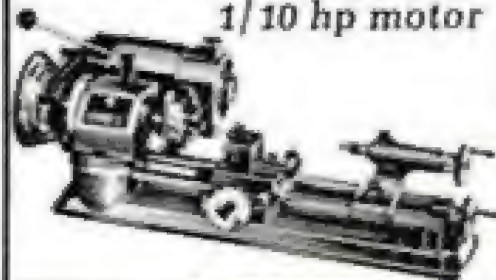
It sounds like a promising way to run a railroad. ★★★



# FIGHT CANCER



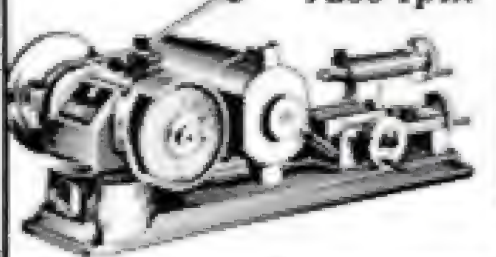
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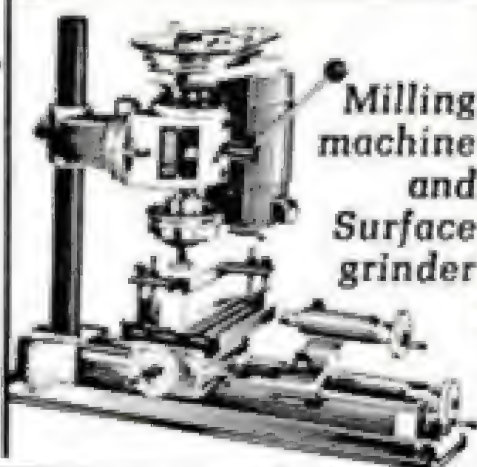


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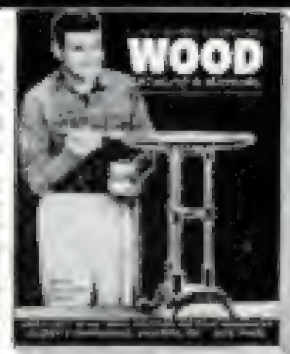
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## BIG WONDERS

(Continued from page 135)

the images don't smudge. And for computer print-outs, there are no carbons to jam or ribbons to break.

It looks and feels pretty much like ordinary paper. But it comes in a sandwich. The underside of the top sheet has a coating of millions of tiny capsules (some four million to every square inch) and each capsule holds a small amount of colorless dye. The face of the second sheet has a fine coating of white clay.

When broken by the pressure of a typewriter letter or ballpoint pen, capsules release dye that reacts with the clay to form a sharp, blue image. (It's estimated that the letter "o" on a standard typewriter breaks more than 30,000 capsules.) Of course, the typing on the face of the top sheet gets there the usual way, inked on by the typewriter ribbon.

Once the carbonless paper was pretty well perfected, the NCR researchers looked around for other things to encapsulate. They found them—and are finding more all the time.

Some microcapsules now being made at NCR contain a corrosion-preventive primer for use on aircraft rivets. The rivets are coated with millions of capsules that burst when the fasteners are hammered in. The usual method is to hand-dip each rivet in a wet corrosion preventive just before it's used. That way, a worker can at best put in two or three rivets per minute.

But the coated jobs can be riveted with automatic machines. At North American Aviation plant in Columbus, Ohio, where the rivets are being tested, officials report achieving a rate of 18 per minute. Such speed can be a real time-saver when you're working on a plane requiring 50,000 rivets.

### Knocking out headaches

An application much closer to home was worked out by the scientists at Chesebrough-Pond's Inc. While using the NCR methods, they came up with an improved form of aspirin, probably the most widely used drug ever to come out of a test tube; Americans, according to a Chesebrough-Pond's researcher, gulp down 41 tons of the stuff daily.

But aspirin has a drawback: After three or four hours in the body its effect wears off. So people who suffer from arthritis, rheumatism or the prolonged aches of other conditions, can't ward off a whole night's pain by taking ordinary aspirin at bedtime. They have to get up in the middle of the night for another dose.

The new version, called Measurin, is

said to be effective for eight hours because the aspirin doesn't all go into the system at once, but is doled out at a predetermined rate.

A Measurin tablet is made up of about 6000 minute particles of aspirin, each enclosed in a plastic skin called a semi-permeable membrane. The membrane has submicroscopic holes in it, permitting fluids to flow in and out (as happens when you dunk a tea bag). About 45 seconds after the tablet lands in your stomach it falls apart and fluid enters the thousands of tiny sacs. Inside them, the fluid begins to dissolve the aspirin, which very slowly flows out again in solution. The permeability of the membrane controls the rate of flow.

Another company, Smith Kline & French, has encapsulated a number of drugs, among them belladonna. It's used by ulcer patients to retard acid secretion in the stomach. Using the ordinary form of the drug, patients frequently wake up in the middle of the night with burning sensations in the belly. Microencapsulation is said to make the effect of the drug last 12 hours.

It seems certain that all kinds of encapsulated drugs will be available soon. At least 50 are reported to be under development both here and abroad.

### Bombs for the borer

Another type of "timed" capsule is being used by Department of Agriculture researchers to knock out the European corn borer. Spores of a bacterium, *Bacillus thuringiensis*, which paralyzes the destructive borer, are encapsulated in a variety of wall materials and thicknesses, the average capsule being about the size of a coarse salt grain. Moisture breaks down the capsule walls, turning the bacteria loose against the borer.

A single application at planting time is what government bug experts are aiming for. Some of the capsules are made to break down almost immediately, while others disintegrate at various times throughout the growing season. Though the effectiveness of the method is still being evaluated, researchers are already planning tests of encapsulated chemical insecticides.

Other encapsulated bacteria take rocket rides high above the earth. Space researchers use them as a "biological dosimeter." The number of bacteria killed on a given trip indicates the amount of radiation encountered.

Pressure-activated capsules are used in a new cigaret filter and in cleaning pads for use around the home. The ciga-

[\(Please turn to page 234\)](#)



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## BIG WONDERS

(Continued from page 232)

ret has a filter that contains tiny water capsules. To release the moisture you give the filter a couple of squeezes, and then, according to the ads, "you're ready for the freshest taste in smoking today."

The household pads contain a variety of encapsulated liquids—scuff-mark remover, tar remover (for cars), crayon remover, leather conditioner, gun oil, shoe polish. To remove a scuff mark from a kitchen floor, for example, all the housewife has to do is to press the pad against the floor and rub a bit. The initial pressure releases liquid cleaner. The pad, according to the manufacturer—Armstrong Cork Co.—can be used a number of times, until all the capsules are broken. When not in use it remains dry to the touch and so doesn't mess up other cleaning items it may be stored with.

### Chunks of gasoline

Gasoline and other fuels have been encapsulated and formed into bricks that resemble dry sponges. Though they feel completely dry, about 95 percent of the bulk is liquid.

Scientists say the bricks have a long storage life and are easily handled. In military operations, they could be dropped from planes and stacked in the open. Or they could be tied together to make rafts and then towed on rivers. All it takes is a wringer to recover the gasoline.

If needed for heat, the bricks can be burned intact; in tests, farmers have already used them to keep frost from damaging crops.

The most exotic materials to be encapsulated are uranium compounds, a feat accomplished at Battelle Memorial Institute. Seeds of uranium dioxide or dicarbide are given carbon skins to form pellets only 2/100-inch in diameter.

"All the advanced gas-cooled nuclear reactors being discussed today would use fuel in this form," says chemical engineer Joseph Oxley, a key man in the Battelle research project. "There are distinct advantages. You keep the fission products inside the capsule, which eliminates the need to remove them during operation. The reactor needs less shielding and you can run it at higher temperatures. And higher temperatures mean more power."

Where this development may really pay off is in space. The thinking is that encapsulated fuels may power the atomic rockets in our "Rover" program, now being pushed both by the Atomic Energy Commission and the National Aeronautics and Space Administration.

Problems connected with space have given rise to other far-out projects:

- Scientists at Southwest Research are developing capsules to be used to protect spacecraft from meteoroid damage. Encapsulated chemicals would be embedded in a silicone resin skin. When meteoroid damage occurs, the scientists theorize, capsules also are broken, releasing fluids that react with the resin to plug up the hole.

- Another scheme based on the same principle has been cooked up at NCR. Highly compressed soft-foam structures would be shot into orbit for use as space stations or huge antennas. Once up, they pop out of their cans and expand tremendously. Then they're made rigid by encapsulated chemicals embedded in the foam. Heat from the sun could pop the capsules.

- What's the best way to anchor an astronaut working on the outside of a space vehicle? People at NCR say the answer may be *glue*. They base their thinking on what they've accomplished in putting up glues in stick form. (A "stick" actually is millions of capsules of glue pressed together. It remains dry and untacky until pressed against a surface and capsules broken, and it can be used until no more capsules remain.)

Researchers have designed a harness with three legs attached to it for the astronaut to wear. A capsule of adhesive is affixed to small pads at the end of each leg. When the astronaut maneuvers the tripod against the vehicle, the capsules rupture and the superstrong glue takes hold. To move, he triggers controls that cause the pads and leg bottoms to separate. The used pads remain on the vehicle, and new ones fall into position at the ends of the legs.

This way-out system, now undergoing intensive tests, is being developed for the Air Force. ★ ★ ★

### Skin talk

Electrical impulses which are sent directly to a soldier's skin may be the Army's method of silent communications in the future. Scientists are trying to develop a system in which messages are transmitted between a leader and his men by means of electro-pulses which the men would feel but not hear. Vocal communications are sometimes impossible because of noise of battle or the need for stealth. The system envisioned will use a push-button transmitter to send short-range radio pulses. Each receiver would pick up these pulses and convert them into electro-pulses which would then be sent to electrodes embedded in a belt or vest-type garment worn by the soldiers.



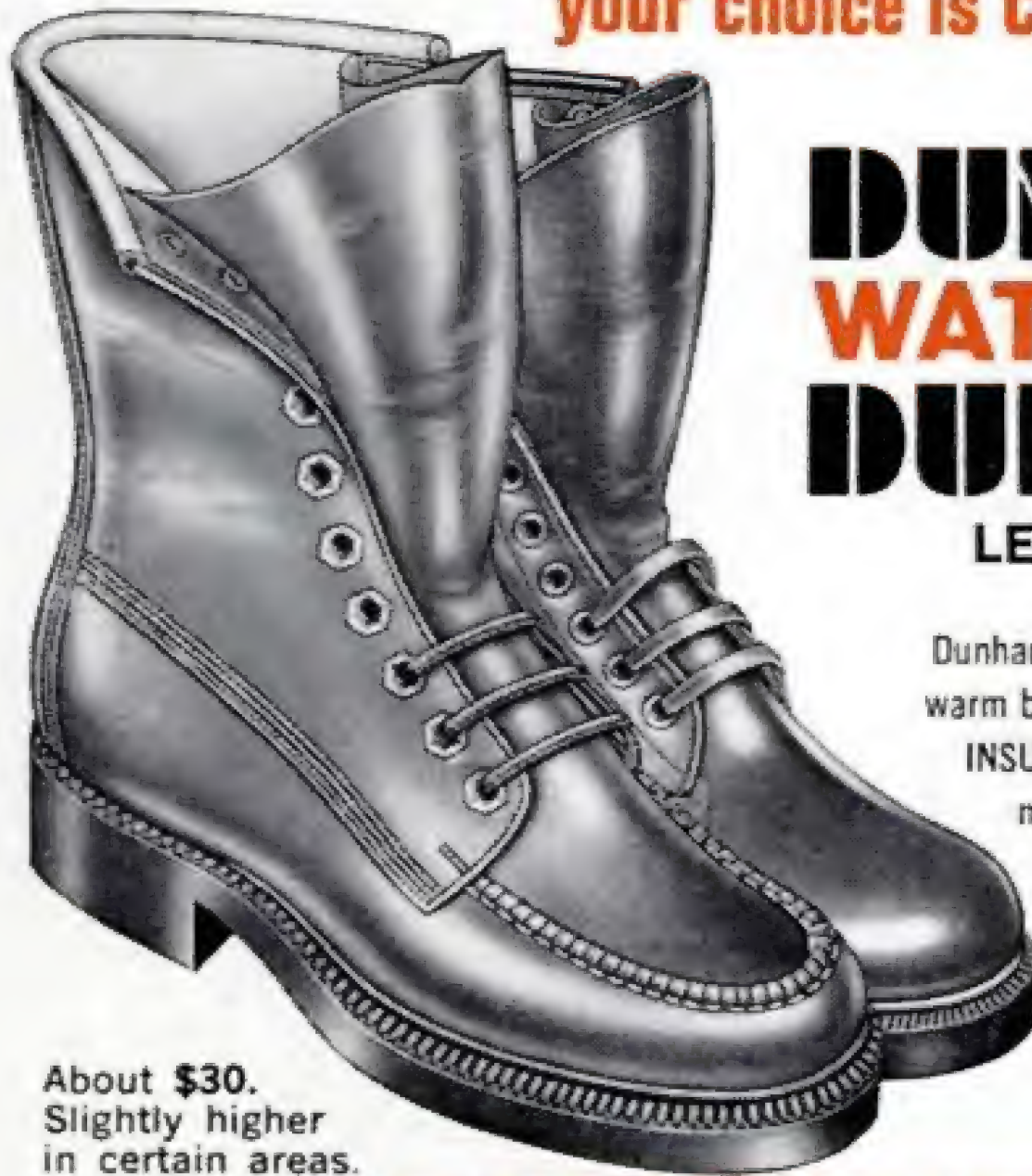
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## SALTON'S SAVAGE 500

*(Continued from page 140)*

either. With its over-revved engine and exotic fuel, this combination won't stay together for hours on end.

Nor is brute power, all by itself, enough to win. It's true Ramos won twice with a dehorned (supercharger removed) Allison aircraft engine, yet only one of the other five big aircraft engines in last year's race managed to finish.

Last year nearly all the finishers in the inboard division were powered by reworked automobile engines, mostly 427-cubic-inch Fords. Some boats were driven by two inboards, but none placed among the leaders.

It's a different story with the outboards, for a second engine gives an additional 15-20 mph. How about a bank of three outboards, side-by-side across the stern? This is faster by eight to ten mph than a pair of outboards. Eight boats used this triple power last year. One boat mounted a row of four big outboards across the stern for a theoretical extra boost of another five mph. But three or four engines put the stern so low it's hard to keep the bow down in rough water. And, with each engine gulping more than 12 gallons of fuel per hour, the multiengine rigs call for extra pit stops.

Twin outboards were the most popular rig last year and won the first six places in their division. This year a number of drivers think they have solved the problems created by three engines, and it may be that a triple powerplant will place first.

Rudy Ramos, more than anyone else, seems to have learned the secrets of how to win endurance races. Now 38, Rudy began to race boats 20 years ago when he installed an automobile engine in a hull of his own design. The boat was a success, and other drivers asked for boats just like it. Today, his Rayson-Craft line of boats dominate the long-distance field and have won all the major endurance contests, in some cases many times.

### **Tips from the winner**

First of all, says Ramos, a good endurance boat must give the driver as easy a ride as possible. Thus, a modified V-bottom (with 10° of V at the stern) is more comfortable than a flat bottom. It's also easier on equipment.

Next, a relatively heavy boat contributes to comfort because it doesn't slam around as wildly as does a lighter craft. That's one reason why the hull of a Ramos boat seems overbuilt. A 17-foot, 5-inch glass hull taking an automotive pow-

er plant is one full inch in thickness and has 17 glass laminations.

The hull of Ramos' 20-footer, driven by the 1000-hp Allison, is 1½ inches thick, with 25 layers of glass, plus plywood reinforcing. Ready to go, and with 175 gallons of gasoline and the driver on board, this boat weighs a full 5000 pounds. Yet it's usually the boat to beat.

Aside from a comfortable boat that doesn't pound the driver too mercilessly, and a reliable powerplant, there's at least another big factor in winning—the driver's skill, which these days depends a great deal on the way he cranks his planing plate up and down.

### **Playing the plates**

A boat goes fastest when it is mostly out of water and is "flying low," almost parallel to the surface. But when a boat is trimmed just right for top performance in flat water, it begins to porpoise and bounce when it hits a chop. Down goes speed. That's when the planing plate becomes important.

The plate is a narrow, hinged shelf across the stern—literally an extension of the boat's bottom. Normally it lies flat. It can be tipped downward, one degree at a time, by a control at the driver's right hand. Each degree of tilt tends to raise the boat's stern and lower the bow.

After rounding each turn, an expert driver cranks his plate up or down just enough to keep the boat trimmed to its fastest attitude, depending on the diminishing fuel load, the roughness of the water, and the force and direction of the wind.

In addition to using a small planing plate or none at all, some outboard drivers operate a pump handle to tilt their motors so that the lower units change their angle of attack. When the water is smooth they tilt the lower units aft. Rpm picks up and the boat rides higher and faster. However, the boat is now hard to control in rough chop and the lower units must be jacked forward again.

True long-distance racing (like the Salton Sea 500-miler, the nine-hour Colorado River marathon, and the nine-hour Orange Bowl classic at Miami) is only five or six years old. A few lesser endurance grinds have been dropped, yet the sport seems to be growing. There's talk of a 500-mile race in San Diego next year, of a 250-miler in Long Beach, Calif., and an eight or nine-hour competition in Texas.

If you happen to attend one of these endurance events you'll always be able to spot one of the indomitable racing pilots after the race. He's exhausted, worn out, and happy to be in one piece. ★ ★ ★



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**CLAMP STEEL SLIDES** to planks with lag screws so they won't move, then install journal plates and weld top edge of plate to edge of base angle to make the journal plate and steel frame a single unit

## TABLETOP PRINTING PRESS

*(Continued from page 156)*

group to a press fit in the i.d. of the pipe. Dismount the plates and bore out the center holes to fit the  $\frac{3}{4}$ -in. cold-rolled steel shafting, holding them in the universal chuck and using a boring tool for close tolerance.

Insert the plates about  $\frac{1}{4}$ -in. into the ends of the pipe and weld them, then insert the shaft and weld it to the plates at both ends.

The end-plate unit is prepared for the blanket cylinder by inserting it into the 5-in. pipe and welding it in, the threaded rod being replaced with  $\frac{3}{4}$ -in. cold-rolled steel shafting. The center pipe shown is a piece of 2-in. with the ends faced off square in the lathe.

After the blanket cylinder has been machined and polished, a double line of holes  $\frac{1}{2}$  in. apart is drilled along one side as shown in the drawing on page 154. The rubber blanket is then wrapped around and clamped down under a strip of  $\frac{1}{8}$  x 1-in. aluminum.

The rubber blanket is standard lithographic equipment and can be purchased from a dealer in lithographic supplies (the California Ink Co., for instance, which has offices in most large cities). The blanket comes marked with parallel black lines on the back and goes on the cylinder with the lines wrapped around it. The blanket is cut to fit the cylinder and punched (with a paper punch) at each end for the clamping screws. One end is fitted loosely under the clamp and the screws inserted. The other end is then brought around, inserted under the clamp, and the screws tightened. There must be no bulges or looseness in the fit of the blanket.

All roller shafts must be center-drilled for mounting between centers on the lathe. Owners of small lathes can have the shafts center-drilled at a machine shop. I had all of mine done for \$2. Also, since the top and bottom rollers revolve independently of each other, they do not have to be miked to equal diameters.

With the rollers finished, work can go forward on the press frame. I made the side planks of solid 2x8 oak, but I would rather recommend that these be built up to the required  $1\frac{3}{4}$ -in. thickness by laminating plywood ( $\frac{1}{4}$ -in. ply glued between two  $\frac{3}{4}$ -in. pieces) or hardboard (seven layers of  $\frac{1}{4}$ -in.). Either would be less expensive than the oak and would obviate some difficulties in working presented by the oak, such as warping and splitting.

Work the planks together, squaring  
*(Please turn to page 240)*



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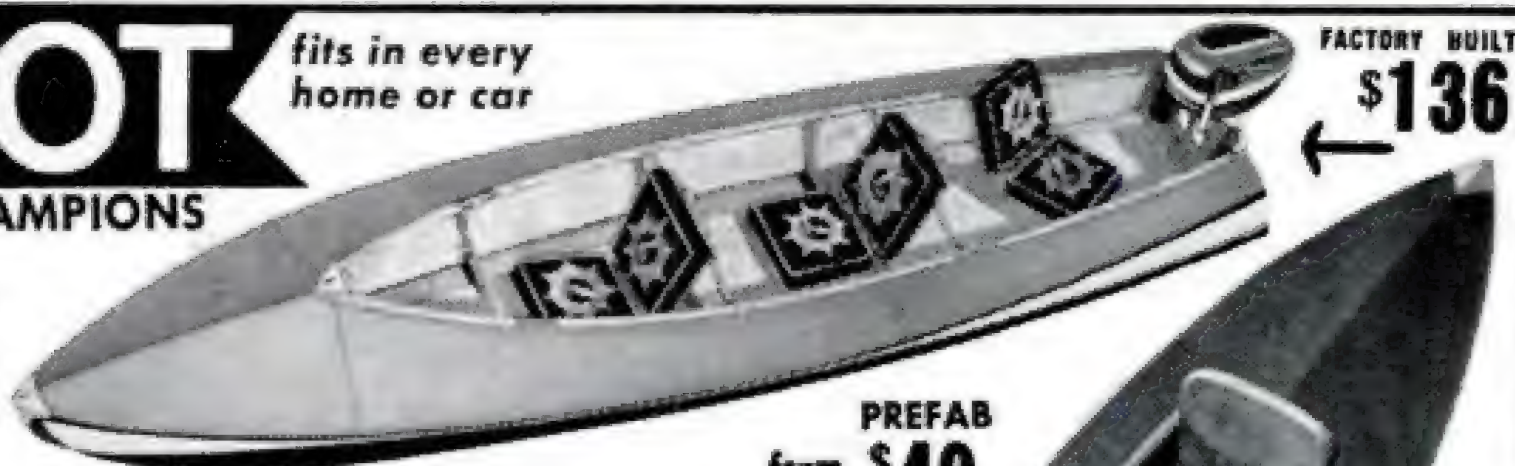
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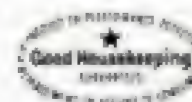
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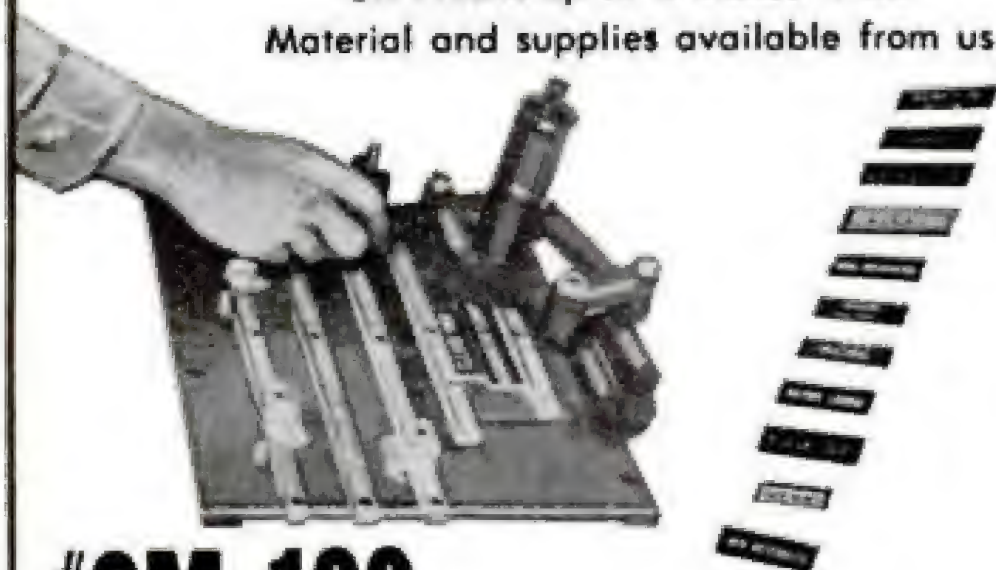




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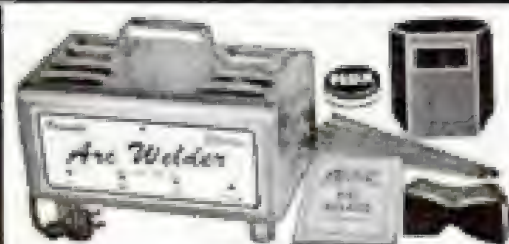
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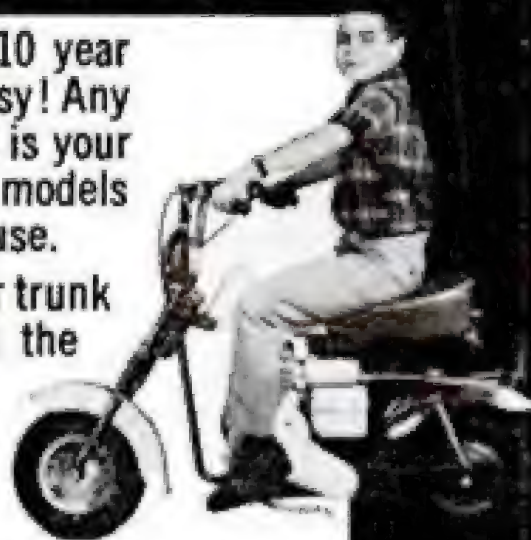
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## TABLETOP PRINTING PRESS

*(Continued from page 238)*

both to exactly the same dimensions. Rout out the journal plate seats on the inside faces of the planks. The base angles holding the steel upper frames to the planks must, of course, be square with the planks.

The photo on page 156 illustrates an important step in ascertaining where to place the bed rollers. The planks should be drilled for the bed-roller bolts as well as for those holding the cross frame.

Construction of the welded steel slides for the top-roller journal boxes is detailed at the top of page 154. There is a good possibility that, when the guide units are welded to the base angles, the latter may bow (unless clamped to a heavy welding table).

The bow of the base angles will be toward each other, making assembly of the press impossible. However, if this does happen, it can be corrected by following the procedure shown in the drawing on page 154. After grinding off the bead indicated, check the straightness of the base angle with a straightedge. If it is still bowed a trifle, another bead welded over the ground-off remains of the first will be in order. The base angles must be perfectly straight.

*(To be concluded next month)*



A hot-rod start for rockets is provided by a standard Army 155-mm field gun. Lockheed technicians are shown here loading a prototype high-performance rocket into a gun. A standard powder charge drives the projectile out of the barrel; once free of the barrel, the rocket motor ignites to propel the projectile to its target. Tremendous range increases are expected from the system.



# FLYING SAUCERS

(Continued from page 219E)

had encountered a particularly vivid UFO sighting near her home.

I talked with Mrs. Blodgett, President of the New Hampshire P.-T.A. in her restored pre-Revolutionary farmhouse.

"I was going to bed," she said, "between 1:30 and 2:00 a.m. I turned off the lights and I suddenly saw this bright, blinding ball of light over the trees, about a hundred yards away."

"Are there any high-tension power lines near here?" I asked.

"What are they, exactly?" she said.

"They're the high poles or towers that carry electrical power. Not the ordinary poles that go along the road. These usually go across country, with a wide path cut through the trees."

"Now that you mention it," she said, "I think there are. Right down the road here."

I went out and looked and about a quarter of a mile away, I saw familiar poles and heavy strands of wire.

## High-power lines

From Shaw Hill it is only a short drive to the spot where Muscarello, Bertrand and Hunt watched the object hover above them. I walked across the field, and down the slope, as Bertrand and Muscarello had done. I was almost shocked to see what I had been looking for: a long line of high poles and wires of high-power transmission lines.

The next Monday, Nov. 8, I went back and re-interviewed some of the people I had talked with earlier.

Joseph Jalbert and his mother brought me up-to-date on a sighting Joseph had made since I had first met them. Joseph had noticed a reddish, cigar-shaped object in the sky, high over the power lines. It hovered there motionless for several minutes. Finally a reddish-orange disc emerged apparently from inside the object, and began a slow, erratic descent toward the power lines. When the disc was within a quarter mile of them, it leveled off, then moved over the wires until it reached a point several hundred feet away.

It then descended slowly until it was only a few feet above the lines. Then a silvery, pipelike object came down from the base of the disc and actually touched the lines, remaining there for a minute or so.

The protrusion then slowly retracted into the body of the object, and it took off at considerable speed, rejoined the cigar-shaped object, and disappeared inside.

The night of Tuesday, Nov. 9 was cold and sparkling clear, with a brilliant moon. As I was leaving my room about 5:30 I noticed the lights flickered, faltered for a few seconds, then came on brightly again.

The waitress who brought me a menu had a smile on her face. She had supplied names of people who had sighted UFOs and was interested in my investigation. "I suppose this is all your fault," she said.

"What is all my fault?" I asked.

"You mean you haven't heard about it?" she said.

"Heard about what?"

"The blackout. The power failure. All over the East."

"You're kidding," I said. The lights in Hampton were blazing brightly. I did recall, though, the flicker as I left my room.

"It just came in over the radio," she said. "New York, Albany, Boston, Providence, all of Massachusetts are absolutely black. This is no joke, I mean it."

I got up, went back to my room, turned on the television.

## Words appear 73 times

I was startled to see the staff of NBC-TV broadcasting by candlelight. The commentary confirmed all the waitress had said. The first thing which crossed my mind was the series of UFO sightings involving power lines. I started through my 203 pages of tape transcript. The words "power lines" or "transmission lines" appeared 73 times!

I sat glued to the television. The commentators were as confused as everybody else. No one seemed to have any idea of the cause. The Portsmouth-Exeter area, we learned, was one of the few pockets of light in the entire Northeast.

The relationship of the Unidentified Flying Objects to power failures is entirely circumstantial, of course. Both UFOs and the Great Blackout still remain unsolved. But stranger yet is the incapacity of science to come up with a real answer to either. More baffling still is the attitude of the large bulk of the scientific fraternity in presumably laughing off a phenomenon testified to by hundreds of technicians, other scientists, airline pilots, military personnel, local and state police, and articulate and reliable citizens. ★ ★ ★

## Easier paint removal

When refinishing, be sure to remove all loose paint with a wire brush before applying paint remover. It will make the actual removal job less messy.



## POLARIS MISSILE SUB

*(Continued from page 116)*

recharge their batteries and refresh their breathing atmosphere. By contrast, the atom sub can stay down practically forever. Its powerplant runs without air and generates enough electricity to manufacture breathing oxygen by electrolysis of seawater. What then is the limiting factor? "The stomach," quipped Lt. Nobel, munching on freshly baked sponge cake. "We can stay down till the food runs out."

Even as atom subs go, the *George Bancroft* is something special. Newest of its kind to enter service, it belongs to the latest type of SSBN (Submarine Ship Ballistic Nuclear) that differs from earlier atom subs somewhat the way a Thunderbird differs from the Model A.

Unlike older subs, the *Bancroft* carries Polaris A-3 missiles, whose 2500-mile range beats earlier types by 1000 miles. Since no place on dry land is more than 1500 miles from shore, this puts every city on earth within the sub's firing range, with room to spare.

Another innovation is the *Bancroft's* whale-shaped hull—a kind of underwater fastback with tapered tail—which ups her top speed to . . . well, forget it.

Her navigation system is a scientific marvel. SINS (Ship Inertial Navigation System) automatically keeps track of her every move—tells you instantly where you are anywhere in the world. To double check SINS, she has a special periscope that sees stars from underwater, to provide a stellar fix. And to top it off, there are several other secret backup systems which I suspected but could only guess at.

Within her thick-steel pressure hull, built to withstand 80,000 pounds per square inch, everything floats on sound-deadening material so that almost no external noise betrays the sub to harking enemies.

Her striking power is incomprehensible, at least in human terms. She can send off all her 16 missiles toward 16 different targets in an unbelievably short time. Imagine a shower of death falling on an area larger than half the United States—all from a single ship invisibly nested in the depth of the sea!

### **Torpedo attack**

Walking back to my bunk, past rows of magnificent machinery arrayed in flawless functional logic, I couldn't help thinking: "What a beautiful thing she is!" But I could take no joy in her beauty, remembering those 16 horrendous missiles.

**"BATTLE STATIONS—TORPEDO!"**

A blood-curdling horn woke me at 0530. Sonar had located our target—a seagoing Navy tug. The torpedo we planned to fire was unarmed and it was set to pass harmlessly beneath the target ship's keel. Had the "fish" been aimed higher and armed with a warhead, it wouldn't just sink a ship; it would shred it to shrapnel.

Everything else was real enough. "DEPTH 61," commanded the X.O. The sub quickly soared up to a level that permitted the periscope to peer above the surface.

"LOOK AROUND," the next command rang out. Like a dancer waltzing with a girl, the observation officer grabbed the two arms of the periscope and swung it through a complete circle—making sure no surface vessels were near enough to spot us.

"RANGE 7100, BEARING 125," announced the observation officer at the scope, which has a built-in ranging radar for measuring target distance. Another reading, moments later, established the target's own speed and direction of travel.

"DOWN 'SCOPE." As quickly as it had been raised, the long tube slithered back down into the hull. Nothing now showed above the surface. Not even a keen-eyed enemy would have spotted the tiny periscope tip miles away amidst the waves during its brief moment of exposure.

"Besides," explains navigation officer Lt. Frank Shaughnessy, "the whole job could have been done without sticking up the periscope. Sonar alone can usually spot and range the target. But," he adds wistfully, "sometimes we have a problem with fish. They're too noisy. Their mating calls throw off the sonar."

Two men in the central control area were cranking target data into a dial-studded computer, which now locked the sub's nose on the moving target. Up front in the torpedo room, the crew readied the high-pressure water ram that pushes the torpedo from its launch tube. Back at control, a light flashed on the console: "TORPEDO NO. 1 READY." The computer reported: "TARGET IN RANGE/LAUNCH FEASIBLE."

"FIRE!" the X.O. orders calmly.

The ship humps a little from the recoil. Then silence.

The drama now is on the sonar. Two blips light the tube screen. One is the enemy. The other, creeping slowly toward him on the tube, is our own torpedo. The suspense lasts nearly half a minute. Then the two blips on the sonar screen meet and blend—our "fish" had found its mark.

The phone doesn't just ring; it yelps

*(Please turn to page 244)*



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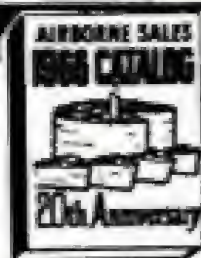


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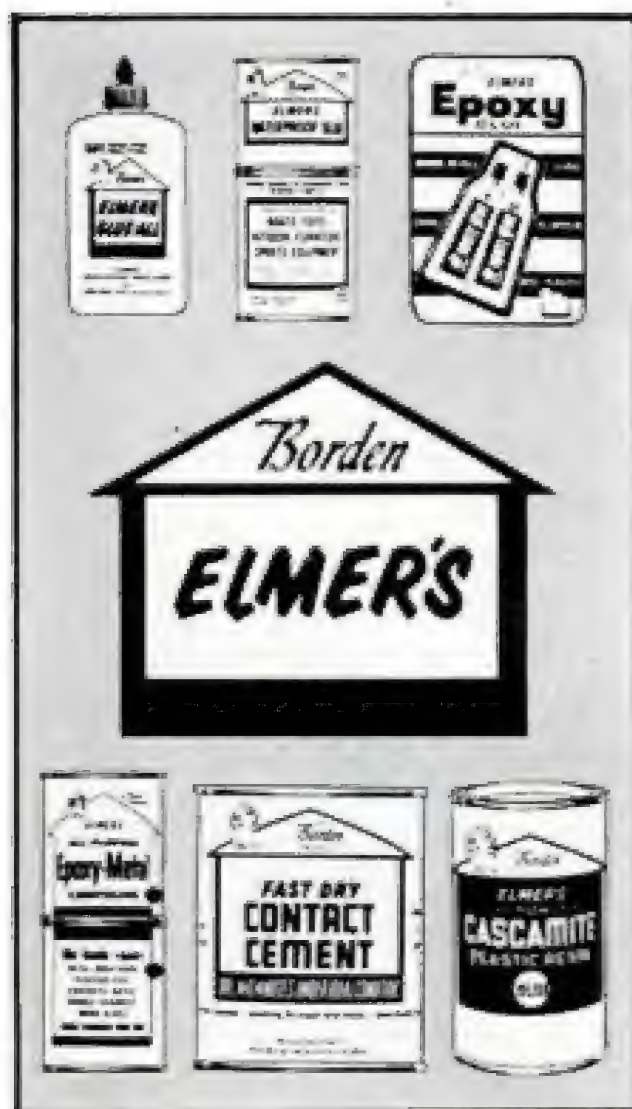
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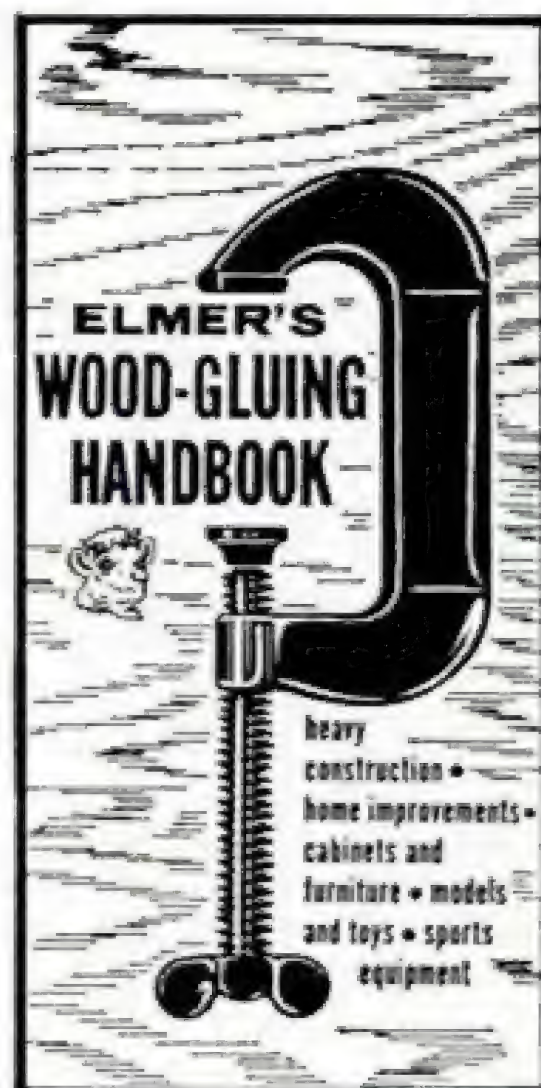
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## POLARIS MISSILE SUB

*(Continued from page 242)*

like an excited pup. The captain lifts the receiver, then flips a switch that lets everyone hear on the intercom.

The enemy is calling on the radiophone. "Congratulations," snarls the tug captain. "Torpedo MOT (Middle of Target). You hit us amidship. We could see her swim right under us."

### Missile loft safeguarded

Compared to the excitement of the mock torpedo attack, the launching of the city-crushing Polaris—the ship's main weapon—seemed almost tame. The whole sequence, nearly fully automated, struck me as eerie and somehow unreal.

Our dummy missile was a SABOT, a water-filled cylinder of better than 17 tons, equal in weight to a Polaris A-3. It was to be launched from deep submersion. But unlike an actual missile, it had no rocket engine to carry it to a distant target. It would just plop into the sea.

In an actual launch, the target is identified only in multiple codes that must be cross-checked by several officers for verification. This guards against possible error. None of these men know which city is their mark. None can change the target.

Nobody aboard can start a personal war by pushing a button. Before any missile is lofted, the captain must turn an "enabling key"—like the ignition switch on a car. But that alone does not complete the launch circuit. Two other officers, in different parts of the ship, must confirm the launch order with their own keys. Being positioned far apart, none of these three men can force the others to loft a missile, as might happen if one of them goes insane.

**"BATTLE STATIONS — MISSILE."** Back in the missile room, the 16 launch tubes stood like gigantic tree trunks. The launch computer had digested the coded target information, checked the ship's own position and depth with the inertial navigation system. A signal light confirmed that the heavy steel hatch covering No. 8 tube had swung open.

Only one factor remained to be checked: surface waves. For, to avoid a sideways kick from rough seas, the missile must pass the surface exactly in the middle of a trough between two waves. A special sonar device analyzed the wave patterns above us. At last, it spotted just the right moment of calm. Automatically a blast of compressed gas drove the missile upward.

The recoil slammed the ship downward, shuddering in the water. The steel

groaned. But moments later, the tension relaxed, both in the hull and in the crew's faces. All had gone well. The bird was on its way.

### 'Hope we never use it'

What if the bird had been real? What if it were now homing in on a great city populated by millions of noncombatants? What would it be like at the other end of the journey?

I asked the captain how he felt about carrying a cargo of unimaginable horror. "No one likes it," he answered somberly. "But I am convinced it is necessary. I hope to God we never use this ship."

Most of the crew feel the same way. In fact, trigger-happy types are screened out. "I believe in our mission because it keeps global war from happening," says Lt. Tom Priest, an earnest, mild-spoken young man serving as the ship's reactor-control officer. "To keep war from happening," he repeated as if to himself. "That's the meaning of a deterrent. If I thought we'd ever fire those missiles, I wouldn't be on this ship."

One man had a different slant. He was a leathery sailor with a rough Irish eloquence and a hankering for the livelier action he remembers from wartime service on a destroyer. "Here I can blow up a city without getting out of my chair," he grumbled. "Everything's turned around. Women and children are on target. We, the fighting men, are safe. The sea is our ambush. We're hidden. Personal courage and valor have no place. No need for gallantry or daring. Where does that leave the traditional virtues of the warrior?" He looked glum.

No more glory, I thought. Perhaps that's good. Weapons like Polaris are now teaching us to see war as it really is—without glamor. After all, the Russians have missiles, too. ★★★

### Tasty toothpaste

An edible toothpaste has been developed by an Air Force dental research team. They call the digestible discovery Astro-9. Although it looks like ordinary toothpaste and is packaged in the familiar squeeze tube, Astro-9 contains neither the detergents nor the volatile oils often found in the commercial variety. It does, however, have an abrasive that is free of calcium.

While Astro-9 may be just the thing for our present astronauts, the military dentist say it would not be the solution for longer flights. Their goal is to develop a paint-on dentifrice that leaves a protective coating on teeth, eliminating the need for brushing.



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## GLAMOUR IN YOUR PICTURES

*(Continued from page 189)*

damage to the line cord's insulation. Now you can pass the rod through the rear support and screw it into the rear carriage slide. Cut off the projecting thread flush. Then remove the reducing bushing from a custom gearshift knob fitted with a set-screw and extend the  $\frac{1}{2}$ -in. hole all the way through. Mount it after the carriage is mounted in the housing.

Before mounting the medium prefocus socket as shown, insert a T-10P bulb so as to place the filament parallel to the carriage angle iron. Mark for mounting the socket and remove the bulb. Drill  $\frac{5}{64}$ -in. holes for 6-32 screws. Bend and drill the reflector stand as illustrated. Mount a  $1\frac{3}{8}$ -in. reflector on the same side as the stand's base. The reflector face should be  $1\frac{1}{4}$  in. from the center of the bulb. Run an asbestos appliance cord through the control rod and reflector stand and attach it to the socket.

For fitting, remove the control rod but not the cord and place the assembly in a 30-lb. egg-white can (obtained from a bakery), centered over, and parallel to, the can's seam and 1 in. back from the open end.

Then scribe a  $2\frac{1}{4}$ -in.-radius circle centered  $4\frac{1}{2}$  in. from the lip of the can and cut it out. In the opposite side, drill the vent holes. Follow the illustration for drilling the lens hole in the can cover.

To admit the control rod, drill a  $\frac{3}{4}$ -in. hole in the can's bottom,  $1\frac{1}{2}$  in. up from the seam. Make a guide of  $\frac{1}{8}\times 1\times 3$ -in. steel and add a  $\frac{5}{8}$ -in. hole. Drill  $9/64$  in. mounting holes. Place the assembly in the can once more, while threading the cord through the control rod and the control rod through the guide, the hole in the can and the carriage holes. Before drilling the can for attaching the guide, make sure the guide permits freedom of travel for the control rod. Attach the guide with Pop rivets.

### Protect lens from heat

Turning next to the optical system, you'll have to provide a  $4\times 5$ -in. heat-absorbing glass, because the  $4\frac{1}{2}$ -in. Fresnel lens is not heat-resistant. These items, as well as the socket, reflector, bulb and fan, were obtained from Edmund Scientific Co., Barrington, N. J. The supports for the heat-absorbing glass are bent from 20-ga. galvanized sheet. The hook-shaped ears hold the glass away from the lens, and its bent tabs hold the glass in place.

Before attaching these supports, cut the lens retaining ring with its tabs from the bottom of a 5-in. diameter can. Cut the

lens hole indicated in the ring. Drill mounting holes through the tabs and the cover. Place the lower heat-glass support so it will be horizontal when the lid is in place and so it just clears the hole in the lid. Drill through support and lid and attach with Pop rivets. Five inches away, using the heat glass as a guide, attach the upper support.

Next, place the lens in the retaining ring, centering it with rolled-up pieces of asbestos paper wedged at the edge of the lens at the bolting tabs. Bolt the ring to the lid; insert heat glass, and bend heat-glass-support tabs to retain the glass.

### Completing the housing

To finish up the can, make a baffle to fit over the vent-hole section as shown in the drawing on page 189. The fan housing is one piece of 20-ga. sheet. Its  $1\times 3\frac{7}{8}$ -in. front tabs are folded inside and riveted. Then drill the  $\frac{1}{2}$ -in. switch holes. Center the housing over the hole in the bottom of the can, its front  $2\frac{1}{8}$  in. from the front lip of the can. Drill and rivet the housing to the can with the top  $1\times 5$ -in. tabs bent to follow the curvature of the can.

The fan motor stand will have to be built to suit the motor used. The 3-in. fan blades should be centered in the  $4\frac{1}{2}$ -in. hole. Check it for clearance by hand turning and then mount in the housing.

Finally, the yoke and stand. Cut the yoke channel to  $32\frac{3}{8}$  in. and cut the right-angle V-notches in the sides as indicated to permit folding it at right angles. The two upright arms must be in perfect alignment. Drill  $\frac{1}{2}$ -in. holes  $9\frac{1}{2}$  in. on center from the bottom of the horizontal member. Slip a  $\frac{1}{2}\times 12$ -in. rod through the holes to check for a free pivoting action. In the center of the horizontal channel, drill a  $\frac{7}{16}$ -in. hole and tap  $\frac{1}{2}$ -20.

Scribe a line connecting the horizontal diameters of the front and rear of the can along the sides. Prepare the two side plates and mark the can to position them 1 in. back from the lip of the can. Drill into the can where the  $\frac{7}{16}$ -in. center holes are on the side plates. Tap the side plates for  $\frac{1}{2}\times 1\frac{1}{2}$ -in. R.H. machine screws. Turn the screws in from the inside of the can and rivet the first side plate along the scribed line. Insert the projecting studs through the holes in the upright channels, slide on  $\frac{1}{2}$ -in. washers with  $1\frac{3}{8}$ -in. diameters and clamp with lock washers and wing-nuts. Before fully riveting the second side plate, check for freedom in pivoting. Solder the screwheads to prevent loosening.

Mount two 3-amp., 250-v. toggle switches on the fan housing, and wire according to the circuit diagram.



To mount the spotlight for use, first thread a 5-in. length of  $\frac{1}{2}$ -in. cold-rolled steel rod  $\frac{1}{2}$ -20 and attach it to the bottom of the yoke. A photographer's light stand with the sliding rod removed makes an ideal floor stand, but for this, you'll need a longer piece of cold-rolled rod.

For your own table stand, first bore out a  $\frac{1}{4}$ - $\frac{3}{4}$ -in. reducer to  $\frac{1}{2}$  in. Shorten the setscrew in a line shaft collar, mount the collar on a piece of rod and grind it until it will slip into a  $\frac{3}{4}$ x5-in. pipe nipple. Obtain a 1-in. compression spring made from 18-ga. wire that has an inside diameter of  $\frac{9}{16}$  in.

Now, you assemble these elements. Slip an unaltered shaft collar on the rod attached to the yoke, followed by the reducer and followed by the spring and smaller shaft collar.

Compress the spring to the point where you can tighten the setscrew on the lower shaft collar just outside the reducer. This can best be accomplished by placing the lower collar against a stop and pressing against the yoke. Now clamp the reducer in a vise and pull on the yoke to compress the spring still further. Slide the upper collar down to the reducer and tighten the setscrew. This setup will make the spotlight stay where you turn it.

Screw the pipe nipple into the reducer and attach a floor flange for bolting down, or attach the nipple to a weighted base.

The spotlight is now ready for family-pleasing photos. Make sure you always turn on the fan first and let the fan run for a few minutes after turning off the light. ★ ★ ★

## Chimps as middle men

Chimpanzees could be the answer to the scientists' question of when to end animal tests and begin testing humans.

The U.S. Food and Drug Administration is studying the feasibility of certifying chimps for testing new drugs at an intermediate stage before clinical trials get underway and after traditional animal studies are completed.

The theory is being tried on six animals using the drug chloramphenicol under a FDA contract with the Aerospace Medical Laboratory, Alamogordo, N.M.

Reports the FDA commissioner, Dr. James L. Goddard, "We intend to compare these reactions with those we are quite familiar with in man. If a close correlation occurs, as suspected, then the chimp can be 'certified' as a subject for modern toxicology."

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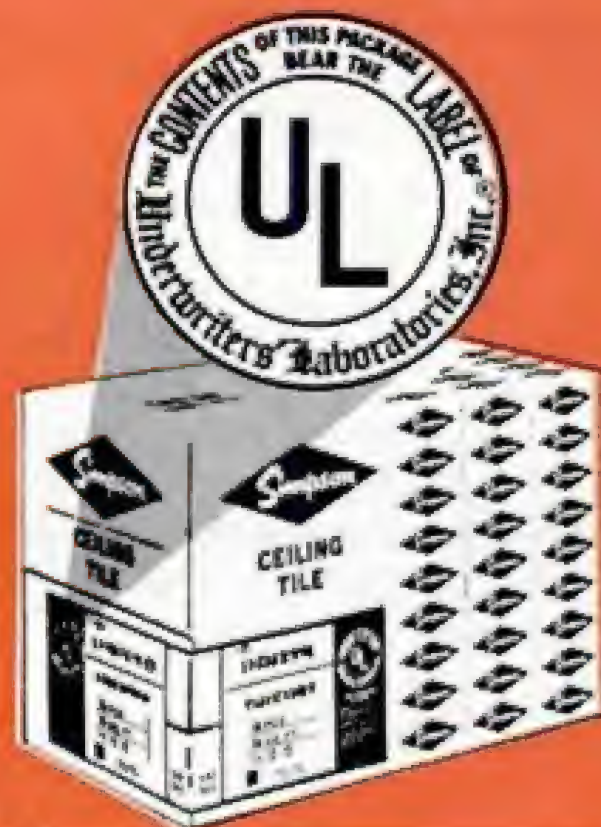
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- No. MM30 Small bar, polished, 1 1/8" x 3 1/8" x 1" ..... 10 for \$1.00
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SAMPLE PAIR SMALL BAR MAGNETS & BARGAIN CATALOG 25c

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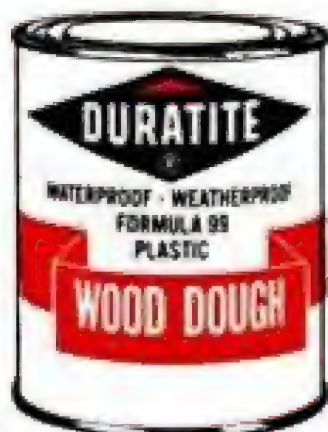


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DAP INC., Dayton 31, Ohio  
SUBSIDIARY OF *Plough, Inc.*

## THEIR OWN GARAGE

(Continued from page 186)

or even colorful fiberglass. All plywood, whether rough-sawn white pine or smooth Douglas fir, should be exterior grade.

Each garage is clearly detailed in cut-away drawings. Door posts are anchored solidly to the floor platforms by bolting them to the inner corners before the floor is nailed. Your platform should not rest directly on the ground. A few concrete blocks partially buried make ideal piers.

While each of our models has a wood floor, yours wouldn't have to. If you'd want to pour a concrete slab, you could. In fact, your floor could be nothing more than gravel with your corner posts being treated with a preservative and set in the ground like fenceposts. You could use a floor of flagstone. Since the roofs are pitched to shed water quickly, a couple coats of porch and deck paint will do without need for actual roofing. While overall dimensions given will accommodate average-size vehicles, it may be necessary to vary the length and the width to suit actual measurements of your particular machine. ★★

## Pruning saves elms

Vigorous pruning and spraying with common DDT solutions have saved more than 400 rare elm trees from Dutch elm disease at Pennsylvania State University, reports Lewis Barr, head of the division of landscape maintenance.

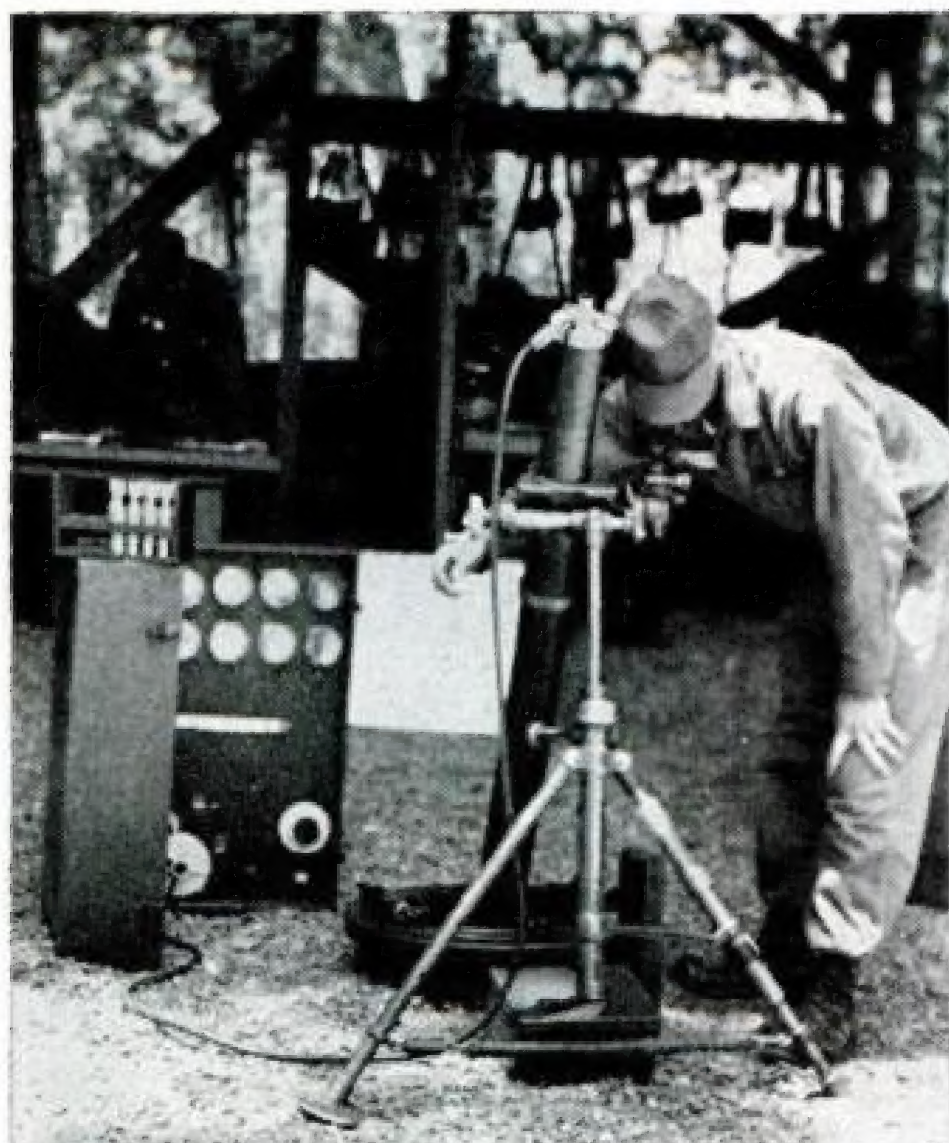
Dutch elm, considered the most destructive shade-tree disease in the United States, had been deemed incurable by researchers who had tried various pesticide remedies. The disease is carried by a fungus found on the feet of a small, brown elm-bark beetle. The female beetle usually lays her eggs under rough bark of a newly dead limb; the fungus then spreads into living limbs, cutting off the sap supply. An entire tree can die within a few years, as homeowners in the eastern half of the country sadly testify.

However, if sick and dead limbs are quickly trimmed and burned, this reduces chances for beetle attack.

## Two billion years old

Clearly identifiable fossils have been discovered in sediments nearly two billion years old. The most ancient known living things are micro-organisms found in the Gunflint iron formations of the northern Lake Superior region of Canada and adjacent Minnesota. The ancient "germs" are known as microfossils.





**Compressed-air mortars** are being used at the Fort Polk, La., special Vietnam training center to give trainees experience in firing a mortar without wasting expensive shells. A regulation mortar—any of the three now in common use in Vietnam—is fitted with a cap and one-inch pipe through its barrel. Compressed air is fed to a quick-release valve at the base of the pipe. When a special miniature projectile is dropped into the adapted mortar, the air valve is tripped and a burst of compressed air “fires” the tiny mortar shell into its trajectory. A 250-psi air charge hurls the miniature missile 1/100th as far as a regulation mortar shell. Once the trainee adjusts the mortar (photo, above) and fires the projectile, observers can tell within seconds how well he has made his calculations by observing where the shell has landed (photo, below). The head of each mortar shell conceals a 22-cal. blank for sound effects, making the miniature setup as realistic as possible.



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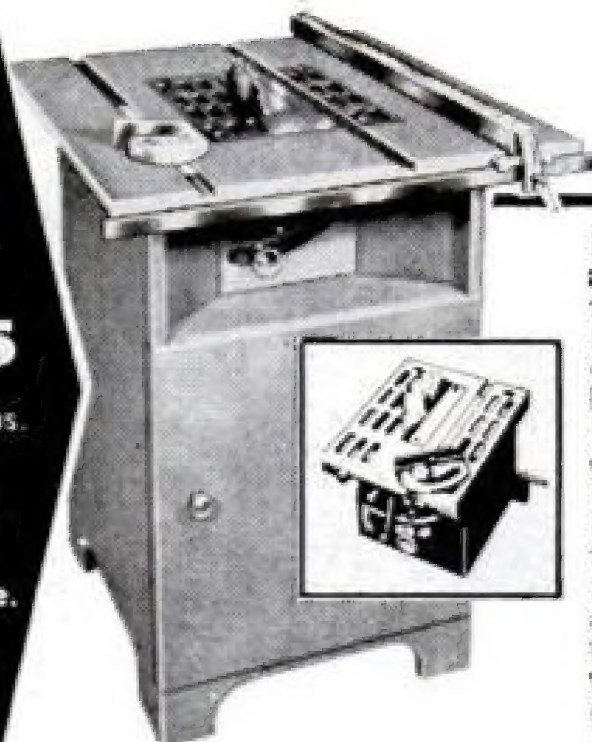
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saw with ground cast  
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Full scale power tools of heavy duty 100% cast iron and steel. Streamlined design reduces weight, cuts material and production costs. Special patents provide added efficiency, accuracy, savings. Parts made, assembled, tested and packed right in our own factories, shipped direct... save store profits.

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**FREE CABINET BASE PLANS**

Use as portable bench saw as re-  
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... sheet of 3/4" plywood and 3-4 hours  
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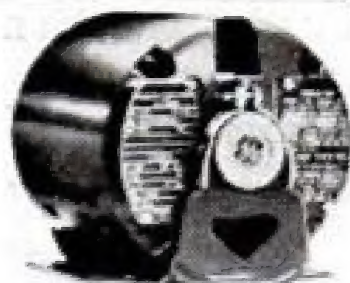
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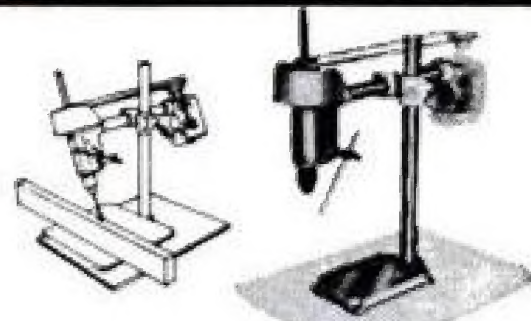
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